IDA PAPER P-2990

COST ANALYSIS OF THE MILITARY MEDICAL CARE SYSTEM: FINAL REPORT

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September 1994

Prepared for
Office of the Director (Program Analysis and Evaluation)

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IDA Log No. HQ 94-45659

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Contract MDA 903 89 C 0003
Task T-Q7-1085

PREFACE

This paper was prepared by the Institute for Defense Analyses (IDA) for the Office of the Director (Program Analysis and Evaluation) under a task entitled, "Cost Analysis of the Military Medical Care System." The objective of the task was to analyze the cost of U.S. military medical-care facilities under current policies and under proposed alternatives. This paper completes the task by describing the data used in the analysis, explaining the cost functions that were estimated, and assessing the in-house costs of four alternatives for peacetime medical care.

This work was reviewed within IDA by Thomas P. Frazier, Timothy J. Graves, Christopher Jehn, Katherine L. Railey, and Karen W. Tyson.

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I. INTRODUCTION AND SUMMARY

A. BACKGROUND

Section 733 of the National Defense Authorization Act for Fiscal Years 1992 and 1993 directed the Department of Defense (DoD) to conduct "a systematic review of the military medical care system required to support the Armed Forces *during a war or other conflict*, and any adjustments to that system required to provide *cost-effective health care in peacetime to covered beneficiaries*." [Emphasis added.][1] To satisfy this mandate, the DoD contracted with several organizations, among them the Institute for Defense Analyses (IDA) to conduct the so-called Section 733 Study. Under two separate task orders, IDA conducted a survey of military health-care beneficiaries, and a cost analysis of military hospitals. The results of the survey analysis are reported in a companion paper.[2] Preliminary findings of the cost analysis were reported in a previous paper.[3] The current paper supersedes the previous one. None of the analyses or conclusions of the previous paper have changed; they have been supplemented by additional analyses not reported earlier.

The motivation behind the congressional concern is illustrated by reference to Figure I-1. DoD medical expenditures may be roughly measured by the medical program elements in Major Force Program 8 of the Future Years Defense Program (FYDP).[4]

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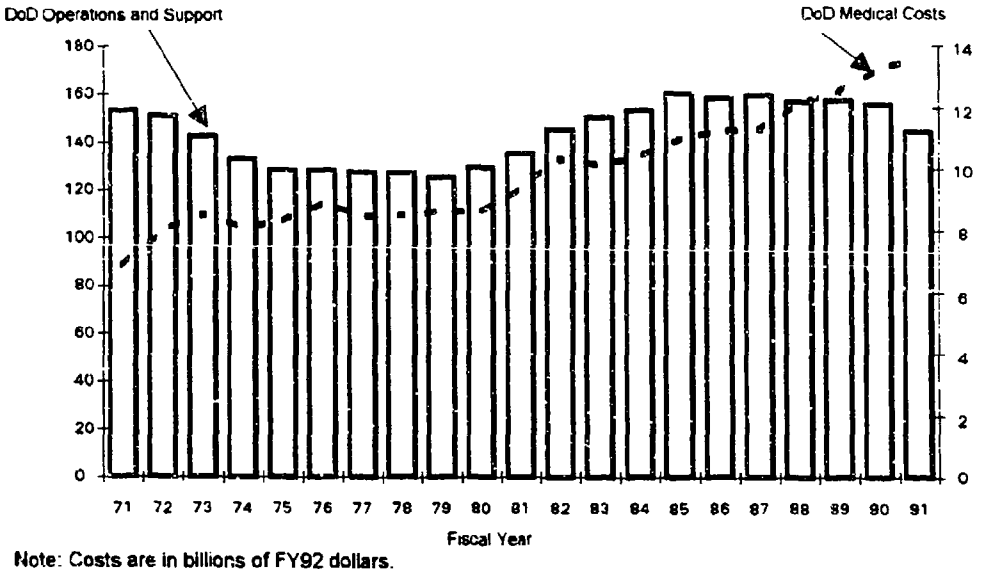
1 United States House of Representatives, "National Defense Authorization Act for Fiscal Years 1992 and 1993," Conference Report, Report 102-311, November 13, 1991, Section 733, pp. 123-126.

2 Philip M. Lurie, Karen W. Tyson, Michael L. Fineberg, Larry A. Waisanen, James A. Lee, James A. Roberts, Mark E. Sieffert, and Bette S. Mahoney, "Analysis of the 1992 DoD Survey of Military Medical Care Beneficiaries," Institute for Defense Analyses, Paper P-2937, January 1994.

3 Matthew S. Goldberg, Joseph F. Dorris, Stanley A. Horowitz, James A. Lee, Daniel B. Levine, Bernard J. McHugh, Melanie G. Mutton, Larry A. Waisanen, Stephen K. Welman, and Kathryn L. Wilson, "Cost Analysis of the Military Medical Care System: Data, Cost Functions, and Peacetime Care," Institute for Defense Analyses, Paper P-2938, January 1994.

4 Chapter II of this paper develops more comprehensive measures of medical expenditures, which consider Major Force Programs other than just Program 8 (Training, Medical, and Other General Personnel Activities). For examining aggregate trends, however, expenditures in Program 8 are quite sufficient.

Measured against the right-hand scale, medical expenditures have grown steadily, reaching about $14 billion by fiscal year (FY) 1991. Medical expenditures have grown even more sharply as a share of the declining DoD budget. The growth in the medical share of the DoD budget is a bit misleading, however, because much of the decline in the overall budget is due to reductions in weapon-system procurement since the late 1980s. It might be argued that weapon-system procurement does not provide a proper basis of comparison for medical expenditures, because the latter are driven more by the existing force structure than by new procurement. Therefore, we have displayed for comparison not the total DoD budget, but rather the total operations and support cost (on the left-hand scale), defined as operations and maintenance plus military personnel cost. Even relative to this more stable baseline, the share accounted for by medical expenditures has shown a dramatic increase.



Note: Costs are in billions of FY92 dollars.

Figure I-1. DoD Operations and Support Versus Medical Costs

The increase in medical expenditures largely parallels that observed in the civilian sector.[5] One partial explanation, often made regarding the civilian sector, is the introduction of new, expensive technology for the diagnosis and treatment of disease. In addition, both sectors are subject to demographic changes that may drive even larger cost growth in the future. For example, retired military personnel are eligible for medical care

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5 The literature is voluminous; one recent example is Burton A. Weisbrod, "The Health Care Quadrilemma: An Essay on Technology Change, Insurance, Quality of Care, and Cost Containment," *Journal of Economic Literature*, Vol. 29 (June 1991), pp. 523-552.

at Military Treatment Facilities (MTFs) on a space-available basis. Retired military personnel under age 65 are also eligible for DoD-sponsored care from civilian providers under the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS). The size of the active-duty force is being reduced, primarily through attrition rather than retirement. The population of retired personnel is projected to remain relatively stable; moreover, retired personnel have longer life expectancies than ever before. Figure I-2 displays official projections from the Office of the Assistant Secretary of Defense (Health Affairs) of trends in the beneficiary population. According to these projections, the number of active-duty medical beneficiaries will decrease from 2.05 million in FY92 to 1.78 million in FY98, a 13% cumulative decline. However, the number of retired beneficiaries under age 65 will decline only slightly over the same period, from 1.16 million to 1.09 million.

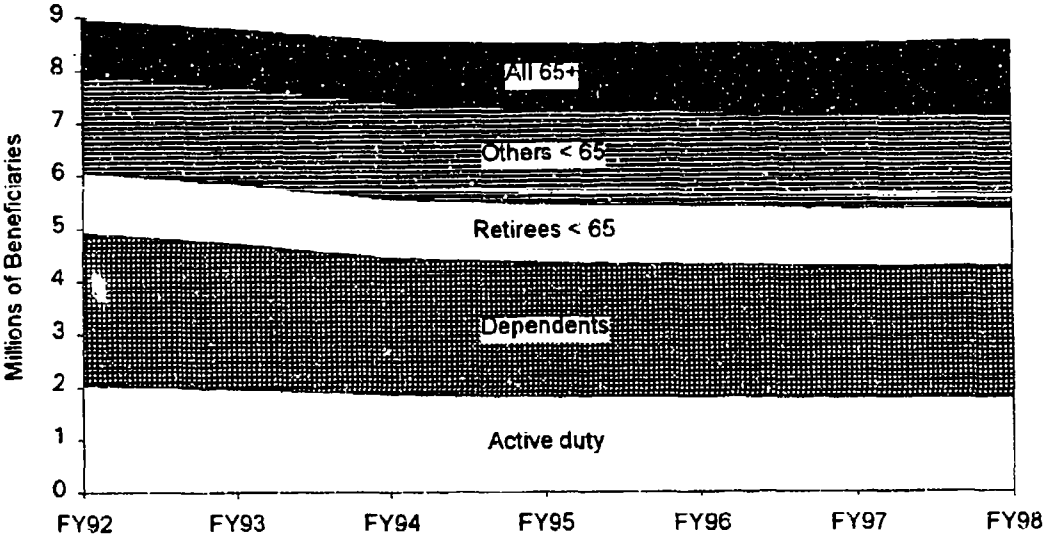

Figure I-2. Trends in DoD Beneficiary Population

B. THE SECTION 733 STUDY

Careful analysis is required to isolate the major components of cost growth in military medicine: trends in the beneficiary population, in per-capita utilization, and in unit cost that are common to both the military and civilian sectors, and differential trends in unit cost between the military and civilian sectors. To help analyze the components of cost growth, DoD formed several internal working groups and contracted with outside

organizations, including IDA. The Section 733 Study was coordinated by the Director for Program Analysis and Evaluation (PA&E). He chaired a Steering Committee consisting of the Assistant Secretary of Defense for Health Affairs, the Assistant Secretary of Defense for Personnel and Readiness (P&R), the Assistant Secretary of Defense for Reserve Affairs, the DoD Comptroller, the Joint Staff Director for Logistics (J-4), and representatives of the three Service Secretaries.

The team structure that supported the Steering Committee is illustrated in Table I-1. The survey of beneficiaries was directed by a DoD working group, chaired by an official from OASD(P&R). In close coordination with that working group, the IDA Survey-Analysis Team designed the survey questionnaire, developed the sampling plan, and analyzed the survey responses. Technical support to the IDA Survey-Analysis Team was provided by the Defense Manpower Data Center (DMDC), which is an element of OASD(P&R). In particular, DMDC fielded the survey and coded the survey responses.

Table I-1. Assignment of Tasks in the Section 733 Study

Organization	Task Description
Beneficiary Survey Working Group [OASD(P&R)]	Survey of beneficiaries
IDA Survey-Analysis Team	Survey of beneficiaries (questionnaire, sampling plan, analysis)
Defense Manpower Data Center	Survey of beneficiaries (fielding, coding of responses)
Peacetime Alternatives and Costs Working Group [OD(PA&E)]	Design, cost analysis of peacetime alternatives
IDA Cost-Analysis Team	Cost analysis of in-house medical system
RAND Corporation	Utilization and civilian cost projections (largely based on survey data)
Wartime Medical Requirements Working Group [OD(PA&E)]	Wartime medical requirements
OASD (Health Affairs)	Other medical issues

The cost analysis was directed by a DoD working group, chaired by an official from OD(PA&E). This paper documents the efforts of the IDA Cost-Analysis Team, charged with estimating the costs of in-house medical care. The RAND Corporation was charged with projecting peacetime health-care utilization under several analytical cases. These cases involve either increasing or decreasing the number of MTFs, plus a variety of contractual arrangements to obtain care for DoD beneficiaries from the civilian sector.

RAND's utilization analysis was largely based on the survey developed by IDA. In turn, RAND's utilization analysis formed the basis for IDA's estimation of in-house medical costs. RAND was responsible for projecting the cost of civilian-sector care under each analytical case.

The development of wartime medical requirements was directed by a DoD working group, chaired by an official from OD(PA&E). A team within OASD (Health Affairs) examined other medical issues raised in the congressional language. In addition to the formal working-group structure, IDA received considerable assistance throughout the study from the staffs of the Assistant Secretary of Defense for Health Affairs and the Surgeons General of the Army, Navy, and Air Force.

The relationships among the various teams are further illustrated in Figure I-3. In close coordination with a working group chaired within OASD(P&R), the IDA Survey-Analysis Team designed the survey questionnaire. RAND contributed some questions pertinent to its utilization analysis. Once the IDA Survey-Analysis Team completed both the survey questionnaire and the sampling plan, DMDC distributed the survey and coded the responses. The raw survey database was then returned to IDA, where the data were "cleaned" (i.e., screened for inconsistent responses) and weighted. The cleaned and weighted data were then passed to RAND for use in its utilization analysis.

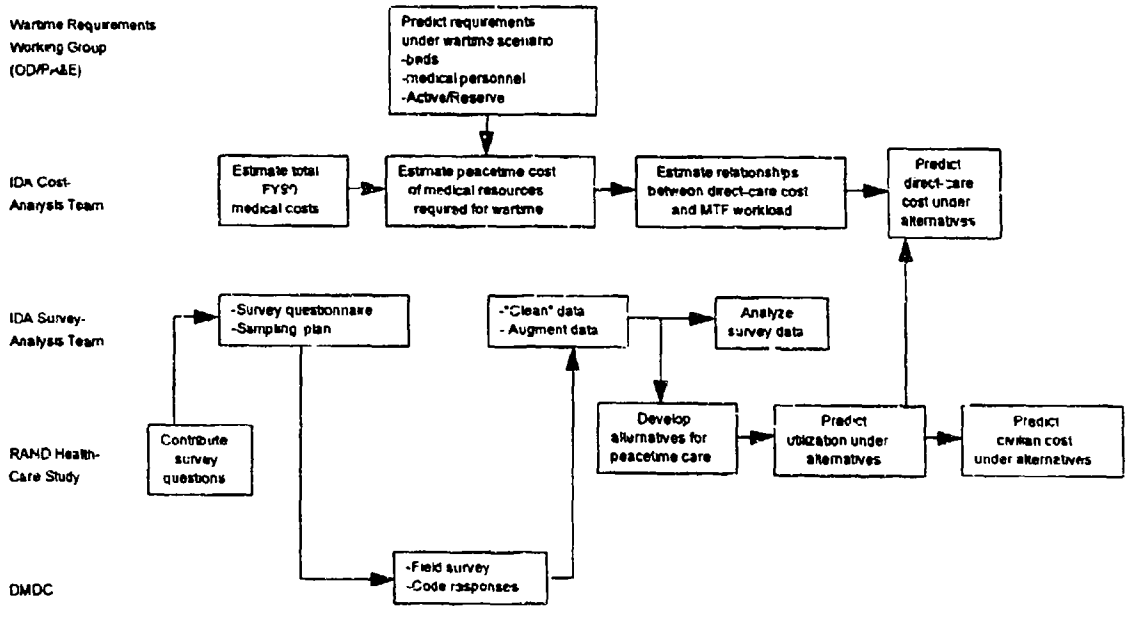

Figure I-3. Information Flow in the Section 733 Study

The upper portion of Figure I-3 describes the activities of the IDA Cost-Analysis Team. The first task was to estimate total medical expenditures in the FY90 FYDP. This task involved identifying medical expenditures outside of Major Force Program 8 (Training, Medical, and Other General Personnel Activities). The second task was to estimate the portion of the total that represents the peacetime cost of the medical resources required for wartime. The wartime requirements, expressed as numbers of beds and medical personnel, were provided by the OD(PA&E) Wartime Medical Requirements Working Group.

The final two IDA tasks were estimating regression relationships between medical workload and cost at MTFs, and predicting MTF costs under each analytical case. Although the four IDA tasks appear separable, the first two tasks delimit the last two tasks in the following way: the analytical cases must preserve sufficient in-house medical resources, even during peacetime, to meet the wartime medical demand. Therefore, cost-effectiveness criteria are applied only to the portion of in-house medical resources above that required for wartime.

Several important qualifications apply to the IDA cost analysis. As stated, the ability to meet wartime medical requirements is preserved in all analytical cases under consideration. Second, the quality of peacetime medical care for DoD beneficiaries is assumed to be constant across all analytical cases. Given these two assumptions, a cost-effectiveness comparison across cases reduces to a simple comparison of peacetime cost.

It is important to note that IDA was tasked to analyze only the costs of in-house medical care. IDA was *not* tasked to perform an overall assessment of the cost-effectiveness of expanding, contracting, or otherwise restructuring the military health-care system. The latter assessment requires as well the RAND Corporation's projections of the cost of civilian-sector care purchased for military beneficiaries. The IDA and RAND cost projections were integrated by OD(PA&E), and appear in that office's executive report.[6]

Note also that IDA estimated only the costs of in-house medical care borne by DoD, not those borne by beneficiaries through deductibles and co-payments. However, deductibles and co-payments are reflected in the executive report prepared by

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6 "The Economics of Sizing the Military Medical Establishment: Executive Report of the Comprehensive Study of the Military Health Care System," Department of Defense, Office of the Director (Program Analysis and Evaluation), March 1994.

OD(PA&E). Moreover, that report also discusses the assignment of responsibility for the employer's share of medical costs and the related issue of DoD collection of payments from third-party insurers. Those important issues involve the shifting of cost among various parties, but do not affect the total in-house costs estimated by IDA.

C. PEACETIME SPENDING ON MILITARY MEDICAL CARE

Chapter II contains our estimate of peacetime spending on military medical care during FY90. We define "wartime" as a situation in which one of the specific scenarios defined by the Wartime Medical Requirements Working Group is in force. All other situations are defined as "peacetime," notwithstanding hostilities or humanitarian efforts in which U.S. forces might be engaged. A portion of the costs incurred in peacetime are generated in an effort to maintain the capability for wartime casualty care. The Section 733 Study takes the view that the resources for wartime casualty care must be controlled by DoD directly rather than by the civilian sector. However, the medical personnel required in wartime need not be drawn exclusively from the active military component, but may also include reservists and DoD civilians. In either case, only the personnel and other resources in excess of the wartime requirement are subject to a cost-effectiveness comparison with the civilian sector in peacetime.

An existing estimate of total medical spending for FY90 was available in the "Cost of Medical Activities (COMA) Report."[7] That report was constructed by identifying fully and partially medical program elements in the FYDP, primarily in Major Force Program 8 (Training, Medical, and Other General Personnel Activities). Our estimate refines the COMA report in four ways:

- incorporation of more recent appropriation data,
- identification of additional military and civilian medical personnel, mostly outside of Major Force Program 8,
- adjustment of pay and allowance factors for military medical personnel, and
- inclusion of permanent change-of-station costs.

The COMA estimate for FY90 was $14.1 billion, whereas our revised estimate is $15.6 billion or 10.6% higher. The breakout by Service is shown in Figure I-4. About half

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7 "Cost of Medical Activities (COMA) Report," Office of the Assistant Secretary of Defense (Health Affairs), April 9, 1991.

of the total adjustment, roughly $750 million, is for military personnel in program elements not considered in the COMA report. Of the $750 million, about $300 million corresponds to medical personnel in Major Force Program 2 (General Purpose Forces). Another $300 million corresponds to Army medical personnel whose Major Force Program could not be determined, though the majority are presumed to belong to Program 2 as well.

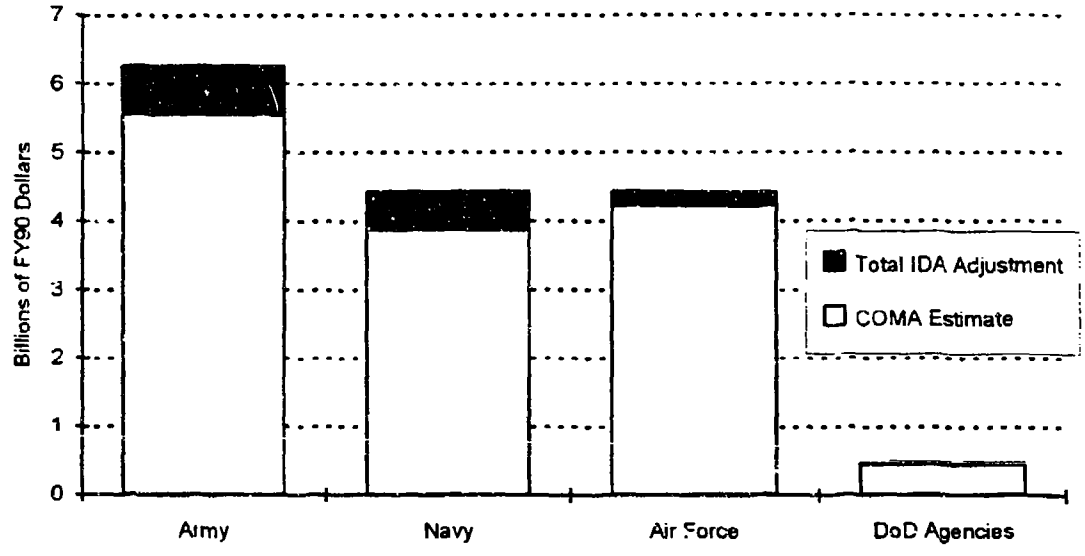

Figure I-4. Summary of IDA Adjustments to FY90 Medical Costs

Chapter IV contains our estimate of the portion of FY90 medical costs required to maintain the wartime medical capability. This capability consists of two major components:

- the casualty-based component, determined by wartime casualty and disease/ non-battle injury (DNBI) levels, and
- the wartime medical structure, composed of medical personnel organic to combat and combat-support units (e.g., the medical platoon of an infantry battalion), and essentially independent of casualty and DNBI levels.

The casualty and DNBI levels were estimated by the Wartime Medical Requirements Working Group.[8] Specifically, they estimated both the numbers of beds (by Service, theater, and echelon of care) and the numbers of physicians (by Service, medical specialty, and Active or Reserve component) comprising the casualty-based component of wartime medical care. In estimating the peacetime cost of these physicians, we assumed that they are occupied in peacetime by practicing medicine at MTFs in the continental United States (CONUS). Each such physician is supported by certain numbers of other personnel (e.g., nurses, medical technicians, hospital administrators, and so on). The resulting "physician team" also incurs non-salary costs for materials, supplies, and capital equipment. We estimated the peacetime cost per physician team using data from the Medical Expense and Performance Reporting System (MEPRS), which is described more fully in the next section. This treatment is conservative, tending to overstate peacetime costs, because some physicians engage in peacetime activities that are considerably less costly than practicing medicine in CONUS MTFs (e.g., serving on headquarters staffs). However, the wartime casualty-based requirements (for both care in theater and care of CONUS evacuees) *could* be satisfied by simply drawing physicians out of CONUS MTFs, and our approach estimates the peacetime costs of these physicians.

A different method was used to estimate the peacetime costs of the wartime medical structure. We selected a subset of the fully and partially medical program elements enumerated in the estimate of total medical cost found in Chapter II. Specifically, we identified medical personnel associated in *peacetime* with combat units, combat-support units, or management headquarters in operational commands. Some 79% of these peacetime costs are found in Major Force Program 2 (General Purpose Forces), and 18% are found in Major Force Program 5 (Guard and Reserve Forces). Note that our approach is based on actual personnel assignments during peacetime, rather than requirements that may be only partially funded during peacetime. In addition, we omitted potential structural elements such as peacetime training, administration, research and development, and Service headquarters. We omitted these elements because it proved impossible to isolate the *wartime* components of the corresponding program elements. Despite our efforts, the concept of wartime medical structure remains poorly defined. An alternative estimate of

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8 "Wartime Medical Requirements Study in Response to Section 733, National Defense Authorization Act for Fiscal Years 1992 and 1993 (U)," Department of Defense, Office of the Director (Program Analysis and Evaluation), Secret, January 1994.

the medical personnel (though not the corresponding peacetime costs) comprising the wartime structure is found in the report of the Wartime Medical Requirements Working Group.[9]

We estimate that the peacetime costs of the structural and casualty-based requirements were nearly equal in FY90, each about $1.2 billion. Figure I-5 shows the breakout by Service, further distinguishing the casualty-based cost by location (theater versus CONUS evacuees). The structural and casualty-based subtotal of $2.4 billion represents 15.6% of our revised estimate of total medical expenditures ($15.6 billion). The Army accounts for 52% of the subtotal, the Navy accounts for 28%, and the Air Force, the remaining 20%.

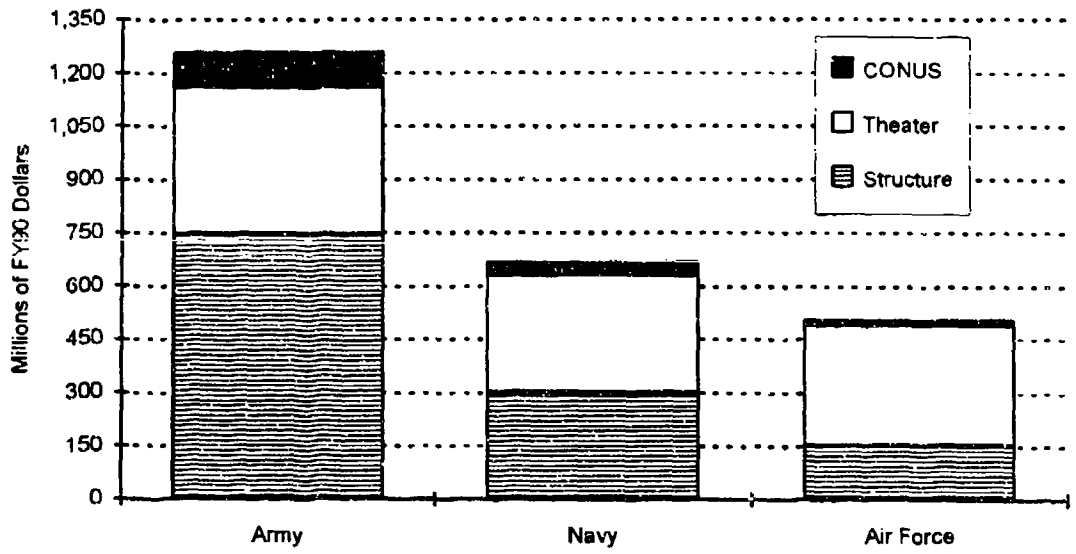

Figure I-5. Total Peacetime Cost of Wartime Medical Requirements, by Location and Service

D. REGRESSION MODELING OF MTF COST

Chapters III and V describe the regression models that IDA has developed to relate cost and workload at MTFs. The primary data source for these models is MEPRS. It is important to recognize that MEPRS is not a patient-level cost-accounting system. Instead, MEPRS reports cost and workload within a three-digit hierarchical chart of accounts,

9 "Wartime Medical Requirements Study in Response to Section 733."

corresponding to workcenters within an MTF. MEPRS includes the costs of materials and supplies, plus military, civilian, and contract personnel. In addition, MEPRS includes a depreciation allowance for purchases of modernization and replacement equipment.

To compare the cost-effectiveness of in-house medical care with medical care purchased from the civilian sector, the same set of cost elements must be present on both sides of the ledger. We investigated six areas in which MEPRS potentially omits or understates cost elements required for comparability with the civilian sector:

- management headquarters,
- facilities construction,
- central automation support,
- MEPRS Special Programs accounts,
- base operations and real property maintenance, and
- military personnel pay and allowances.

The understatement of costs proved significant in all but the final two areas. Table I-2 shows the factors that we developed to adjust for the understatement of costs. These factors are specific to Service and inpatient versus ambulatory care. The factors range between 10.6% and 16.9%, and are described in detail in Chapter III.

Table I-2. MEPRS Adjustment Factors

Service	Inpatient Expenses	Ambulatory Expenses
Army	16.9%	13.2%
Air Force	12.8%	10.6%
Navy	13.3%	11.2%

Chapter V develops the MTF cost models used to project the cost of inpatient and ambulatory care under each analytical case. The models project cost at each individual facility given levels of inpatient and ambulatory workload, physical capacity measured in terms of operating beds, and the volume of Graduate Medical Education (GME) activity. The facility-level costs are then summed over all facilities to estimate the system-wide costs of providing care at military hospitals under each analytical case. Costs of providing care within the civilian sector, and paid through CHAMPUS, have been separately estimated by the RAND Corporation.

The cost models reveal a constant marginal cost of about $3,000 per inpatient discharge from medical centers. The marginal cost per discharge from community hospitals is not a constant; instead, it decreases for the larger hospitals, which exhibit returns to scale. Similarly, the marginal cost of an ambulatory visit is constant for medical centers, constant (at a higher level) for stand-alone clinics, but decreasing for the larger community hospitals. The cost models also contain estimates of the cost per additional operating bed, and the cost per additional resident or intern enrolled in a hospital's GME program.

E. COST PROJECTIONS FOR THE ANALYTICAL CASES

The Section 733 Study examined four analytical cases for the provision of peacetime medical care. The current paper contains summary descriptions of each analytical case, plus detailed development of in-house medical costs. The cases are more fully described in a RAND Corporation publication.[10] The IDA projections of in-house medical costs under each analytical case are found in Chapter VI of this paper. The projections of civilian-sector costs for each analytical case are found in the RAND Corporation publication. An overall assessment of the cost-effectiveness of each case requires integration of the IDA and RAND cost projections, as well as consideration of third-party collections and beneficiary deductibles and co-payments. These overall assessments were performed by OD(PA&E), and appear in the executive report.[11]

1. Cases 1 and 2

Case 1 is a minor excursion from historical FY92 data, reflecting managed-care initiatives that had not yet been fully implemented during that year. Non-active-duty beneficiaries would continue to have a choice between care provided at MTFs and care provided in the civilian sector under CHAMPUS. However, a preferred-provider feature is assumed to be available that offers discounts for care received from civilian providers on a specified list.

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10 Susan D. Hosek, Bruce W. Bennett, Joan Buchanan, M. Susan Marquis, Kimberly A. McGuigan, Jan M. Hanley, Roger Madison, Afshin Rastegar, and Jennifer Hawes-Dawson, "The Demand for Military Health Care: Supporting Research for a Comprehensive Study of the Military Health Care System," RAND Corporation, MR-407-1-OSD September 1994.

11 "The Economics of Sizing the Military Medical Establishment."

Two versions of Case 2 were examined, each involving expansion beyond current MTF capacity. A new hospital would be constructed only if the potential catchment-area population could support at least 70 beds. The only potential catchment area that satisfied this criterion was Fort McPherson, Georgia (near Atlanta), for which a new 94-bed facility was notionally constructed. Using similar factors relating beds to catchment-area population, MTF capacity was increased by a total of 949 operating beds at 16 existing hospitals. These expansions would provide access to MTFs for individuals who currently must use CHAMPUS.

The difference between the two sub-cases rests in the rate at which MTF workload replaces CHAMPUS workload. Under Case 2C,[12] workload is drawn into MTFs at a one-to-one rate, so that total (i.e., MTF plus CHAMPUS) workload is held constant. This case resolves to a pure efficiency comparison between care provided in MTFs and care purchased through CHAMPUS. Under Case 2, it is recognized that the increase in MTF workload would probably exceed the reduction in CHAMPUS workload, as beneficiaries respond to the lower co-payments in MTFs. Total cost is higher under this case, which reflects an increase in demand for medical care as well as an efficiency comparison.

In-house cost estimates for all of the analytical cases are presented in Chapter VI. The increased in-house cost of moving from Case 1 to Case 2C is $265 million or 4.2%. Note again that this comparison does not reflect the net change in the *total* cost of medical care for the DoD beneficiary population. Computation of the net change requires an estimate of the corresponding reduction in CHAMPUS cost, which is found in the RAND Corporation publication and not reported here. The full movement to Case 2, recognizing the increase in total workload, is an additional $206 million or 3.2%. The overall increase in cost is rather modest, because the increase in 1,043 operating beds represents only about 9% of the FY92 capacity of roughly 12,000 operating beds in the United States.

2. Case 3

Case 3 moves in the opposite direction, shifting as many beneficiaries as possible to civilian health care while maintaining the military's capability to treat wartime casualties. The facilities and medical personnel required for wartime would be employed

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[12] The nomenclature "Case 2C" is used because two earlier variations, Cases 2A and 2B, were discarded after preliminary analysis by the study team.

in peacetime primarily to care for active-duty personnel. Non-active-duty beneficiaries could choose from among up to three civilian options (where available):

- Fee-for-Service (FFS) plan, offering the same co-payments and deductibles currently found in CHAMPUS;
- Preferred Provider Organization (PPO), offering a restricted set of medical providers but a five percentage-point reduction in the beneficiary cost share; and
- Health Maintenance Organization (HMO), subjecting beneficiaries to more aggressive management, but offering lower co-payments and a somewhat more generous range of services (e.g., adult preventive care).

Two sub-cases were again examined. Under Case 3A, only six MTFs are retained in CONUS for reception of wartime evacuees and referral to either civilian or Veterans Administration hospitals. Under Case 3B, a total of eleven MTFs are retained in CONUS, providing sufficient capacity for the first 60 days of care required by wartime evacuees under some of the scenarios. The MTFs retained in each sub-case were selected by RAND within guidelines provided by the OD(PA&E). These MTFs are among the newer and better-equipped, are geographically dispersed, and are located close to either major naval ports or Air Mobility Command bases.

The cost of active-duty medical care at MTFs ranges between $1.5 and $1.8 billion under Case 3, depending on the exact sub-case and fiscal year under consideration. Some care would continue to be provided to non-active-duty beneficiaries at MTFs, in part to provide the correct clinical mix for military physicians. For example, cardio-thoracic surgeons would require a number of patients over age 65 to provide opportunities for heart surgery. Even with small numbers of non-active-duty beneficiaries, plus referrals of active-duty personnel from the outlying clinics, excess capacity would persist at the eleven MTFs. This capacity could be filled by non-active-duty beneficiaries being treated in MTFs under the auspices of *civilian* health plans. However, the costs of treating these latter beneficiaries are charged against the civilian health plans, and appear in the RAND estimates rather than the IDA estimates.

3. Case 4

Case 4 requires that non-active-duty beneficiaries enroll in a single medical plan and receive all of their care exclusively from that plan. MTFs would be reconfigured as HMOs, responsible for providing all required care to their enrollees either through their

own staffs or through civilian subcontracts. Other enrollment options might include Fee-for-Service plans and Preferred Provider Organizations. Beneficiaries who select either of those options would forfeit any eligibility for care at MTFs. Finally, active-duty personnel would continue to receive care at MTFs or at the outlying military clinics.

Under Case 4, the military hospital system would directly compete with the civilian sector for beneficiary enrollment. DoD could use premiums to regulate the enrollment decision, thereby assuring sufficient enrollment in the military system to fill MTF capacity. In order to calibrate the enrollment decision, RAND considered three premium structures:

- **Case 4A**. Equal premiums for all plans.
- **Case 4B**: Premiums for civilian plans that exceed those for the MTF plan by $20 per month for individuals and $50 per month for families.
- **Case 4C**: Premiums for civilian plans that exceed those for the MTF plan by $30 per month for individuals and $75 per month for families.

According to RAND projections, Case 4B yields a total of 6.2 million beneficiaries, including all active-duty personnel residing in MTF catchment areas. Compared to FY92 levels, Case 4B yields ambulatory visits within 1% and inpatient dispositions about 20% higher. Thus, Case 4B most closely approximates the current situation, enabling the existing set of MTFs to remain open and operate at slightly more intense utilization levels.

Both workload and cost increase as we move from Case 4A to Case 4B, and again from Case 4B to Case 4C. This result reflects the widening premium advantage that the MTF system enjoys in the latter cases, encouraging more DoD beneficiaries to enroll in the MTF plan. Compared to historical data, total in-house cost is 19.4% lower under Case 4A, but 6.3% higher under Case 4B and 14.9% higher under Case 4C. Of course, computation of the net change in total cost requires an estimate of the corresponding reduction in the cost of civilian health plans purchased for DoD beneficiaries. Estimates of civilian health-plan cost are found in the RAND Corporation publication.

II. PEACETIME SPENDING ON THE MILITARY MEDICAL CARE SYSTEM

This chapter estimates total DoD spending on military medical care during FY90. These costs are regarded as peacetime spending, despite the fact that U.S. forces were engaged in several areas of the world during that year. Such contingencies may very well exist in most future "peacetime" years. "Wartime," in this study, refers to the specific scenario considered in Chapter IV.

The analysis reported in this study makes a distinction between two types of military medical expenditures in peacetime: those that purchase resources in anticipation of wartime needs, and the remaining expenditures, which act strictly as a part of total compensation (i.e., as payment-in-kind). This chapter is concerned with estimating the total level of both types of spending. Chapter IV focuses on the cost of the resources needed for war, and Chapters V and VI consider alternatives to the second type of cost, those that exceed wartime needs.

The cost analysis presented in this and succeeding chapters is limited in several respects. First, it deals *solely* with costs. In particular, the quality of peacetime medical care for DoD beneficiaries is assumed to be constant across all analytical cases, so we are observing pure differences in cost without the confounding effect of differences in quality. Although quality is not explicitly examined in the cost analysis, it was examined in the Section 733 Study via the survey of beneficiaries.[1]

Second, in response to the congressional directive, the costs deal strictly with spending by DoD. The study does not consider the spending for military medicine by other government agencies, such as the Department of Veterans Affairs, which cares for wartime casualties who have been separated from military service. Also excluded are the costs that Service families pay for civilian care through co-payments and deductibles.

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[1] Philip M. Lurie, Karen W. Tyson, Michael L. Fineberg, Larry A. Waisanen, James A. Lee, James A. Roberts, Mark E. Sieffert, and Bette S. Mahoney, "Analysis of the 1992 DoD Survey of Military Medical Care Beneficiaries." Institute for Defense Analyses, Paper P-2937, January 1994.

Those costs are discussed in the executive report published by the OD(PA&E).[2] Finally, all costs in this study are estimated in FY90 dollars.

A. METHODOLOGY

The costs of peacetime spending were calculated by analyzing the FY90 costs reflected in the 1991 Cost of Medical Activities (COMA) report[3] and adjusting these costs for a number of factors developed in this chapter. The COMA was actually an annual series of reports prepared by the Assistant Secretary of Defense (Health Affairs) that identified, by Service and appropriation, Program Elements (PEs) in the Future Years Defense Program (FYDP) that contained medical resources. The COMA report included all the resources for those PEs whose titles and descriptions in the "Program Element Dictionary"[4] indicated that they were obviously fully dedicated to medical care. In addition, it included a *portion* of the resources for a few PEs that were not fully dedicated to medical care but that, to varying degrees, contributed to, or required resources from the medical mission. While the COMA has proved to be an excellent starting point, we felt a number of areas needed adjustment in order to capture the full cost of military medical care. The present study attempts to estimate this cost by making the following adjustments to the COMA figures:

- incorporating more recent appropriation data,
- identifying additional military and civilian medical personnel,
- adjusting the pay rates of military medical personnel, and
- including permanent change-of-station (PCS) costs.

The remainder of this chapter describes the adjustments, discusses the calculations, and presents the numerical results.

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2 "The Economics of Sizing the Military Medical Establishment: Executive Report of the Comprehensive Study of the Military Health Care System," Department of Defense, Office of the Director (Program Analysis and Evaluation), March 1994.

3 "Cost of Medical Activities (COMA) Report," Office of the Assistant Secretary of Defense (Health Affairs), April 9, 1991.

4 "Department of Defense FYDP Program Structure," Office of the DoD Comptroller, Publication DoD 7045.7-H, April 1992.

B. ADJUSTMENTS

1. More Recent Appropriation Data

The 1991 COMA report used cost figures for FY90 that were listed in the FY90 column of the FY92-93 President's Budget. These were the latest figures available at the time. We have used instead figures from the FY90 column of the FYDP database that was used to construct the FY94 President's Budget. The result is that the FY90 data have had an additional two years to stabilize. Table II-1 summarizes the results of comparing the FY90 cost of the PEs contained in the COMA report with the FY90 cost reflected in our later data for those same PEs. The net adjustment is an increase of $217 million, or 1.5%.

Table II-1. Adjustment for Later FYDP Data (Millions of FY90 Dollars)

	COMA	Dollar Adjustment	Percentage Adjustment	FYDP
Army	$5,553.1	$135.8	2.45%	$5,688.9
Navy	$3,863.1	$55.1	1.43%	$3,918.2
Air Force	$4,219.8	$4.5	0.11%	$4,224.2
DoD Agencies	$453.6	$22.0	4.85%	$475.6
Total	$14,089.6	$217.4	1.54%	$14,306.9

2. Additional Medical Personnel

Some 33 Army PEs, 28 Navy PEs, and 36 Air Force PEs were enumerated in the COMA report (see the list in Appendix A). In order to establish whether there were additional PEs that provide funding or support to the medical mission, we obtained a data extract from the Defense Manpower Data Center (DMDC) on military personnel with a medical occupational specialty.

DoD uses two classification systems to describe occupational specialties. The first is a Service-specific system of Military Occupational Specialties, or MOSs. In this paper, we use "MOS" in its generic sense. The Navy's terms for "MOS" are Navy Officer Billet Classification (NOBC) code and Navy Enlisted Classification (NEC) code; the Air Force's term is Air Force Specialty Code (AFSC). There are actually three MOS designations, a "primary" and "secondary" MOS, which describe the individual's formal skill training, and a "duty" MOS, which describes the type of work in the individual's present duty station. For the purposes of this study, we have defined "medical personnel" as individuals with either a medical primary MOS (regardless of duty MOS), or a

combination of medical duty and medical secondary MOS. This definition *does not* include individuals with a medical secondary MOS serving in non-medical duty positions, nor individuals serving in medical duty positions but with neither a primary nor a secondary medical MOS. The latter exclusions amounted to roughly 200 officers (0.4% of the DMDC database) and 6,000 enlisted personnel (5.6% of the database).

The second classification system is a unified DoD Occupational Specialty Code that was constructed several years ago to ease comparisons across Services. The "Occupational Conversion Manual"[5] provides a translation between the two systems by listing the Service MOSs under each DoD code. With a few exceptions, the medical MOSs are those in DoD Occupational Code 6 (Health Care) for officers, and DoD Occupational Code 3 (Health Care Specialists) for enlisted personnel.

DMDC provided a data extract of military medical personnel as of 30 September 1990 (close of FY90). Among other data elements, the extract included the MOS, paygrade, and PE of each individual. Using this extract we were able to identify both medical personnel assigned to COMA PEs, and, more importantly for the purposes of the adjustment under discussion, medical personnel assigned to PEs not found in the COMA report. Using data provided by the individual Services, we conducted a similar analysis for civilian personnel. Because we did not intend to make any adjustments to civilian pay rates (for reasons discussed elsewhere in this chapter), we were primarily interested in identifying "additional" civilian medical personnel (those with a medical specialty but not in a COMA PE). While we identified many fewer civilian personnel than military personnel, it is interesting to note that every Service reported some medical civilians in PEs that were not identified in the COMA. The PEs and associated medical personnel identified by this approach are listed in Appendix A, along with the PEs reported by the COMA.[6]

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5 "Occupational Conversion Manual: Enlisted/Officer/Civilian," Office of the Assistant Secretary of Defense (Force Management and Personnel), Publication DoD 1312.1-M, June 1991.

6 This procedure had to be slightly modified for the Army, because the DMDC does not have PE data for the Army. By using an extract from The Army Authorization Document System (TAADS) database provided by the U.S. Army Force Integration Support Agency (FISA), we identified the Army Management Structure (AMS) codes for Army military medical personnel. Then, by employing an AMS-to-PE crosswalk provided by the Army comptroller, we translated these AMS codes into PEs. This procedure created a bias. Whereas the DMDC database reports personnel actually on board Army-wide, the TAADS database reports the number of personnel authorized in specific units. Some differences are significant. The DMDC database lists 59,350 Army military medical personnel in FY90 (those with a medical primary or duty MOS), compared with only 55,928 in the TAADS extract database. In addition, of these 55,928 personnel, only 52,580 had AMS codes

It was originally our intent to classify as "additional" all medical personnel in the DMDC database who were not identified in COMA PEs. However, in comparing the personnel data between the DMDC database and the FYDP (the source of the COMA), we found some disparities in personnel assignments. For example, the number of *medical* personnel given by DMDC for some PEs exceeded the *total* number of personnel shown in the FYDP. While the number of these instances were few, they alerted us to the possibility of double-counting if we made our comparison at the PE-level. In order to minimize this possibility, we decided to make our comparison at the Major Force Program (MFP) level instead.[7] In essence, rather than comparing manpower in DMDC PEs to manpower in COMA PEs, we first totaled the number of each by MFP and then made our comparison. We have classified as "additional medical personnel" only those individuals in excess of the total number of COMA personnel at the MFP-level. This procedure is accurate provided that personnel assignments by MFP are consistent across data sources, so that any misallocations by PE are averaged-out.

Having identified the additional medical personnel, we proceeded to the next step, which was to estimate their cost. To do so, we multiplied the number of additional personnel by the individual Service FY90 average pay rates for officer, enlisted, and civilian personnel, as shown in the FY92 President's Budget.[8] For example, the number of Army officers was multiplied by the average rate for Army officers, the number of Army enlisted personnel, by the average rate for Army enlisted, and so on. Although the pay rates for military medical personnel are adjusted in the next section, we used Service average pay rates in this section in order to show separately the effects of the two different adjustments: adding more people at the standard FYDP pay rates, and adjusting the rates to reflect the higher pay of certain types of medical personnel.

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that could be translated to PEs. As a result, 6,770 Army personnel (59,350 less 52,580) are in the DMDC database for whom we were unable to identify PEs. We included these individuals in the Army totals (Table II-9) under the category "Non-Program-Specific Medical Personnel."

7 Eleven Major Force Programs, each an aggregation of related program elements, together comprise all of the resources in the DoD budget. Medical expenditures by Major Force Program are detailed in Tables II-8 through II-12 later in this chapter.

8 There is a slight inconsistency in this approach. Whereas the number of medical personnel, which have all been obtained from the DMDC database, are end-strengths (the number present on the last day of the fiscal year), the FYDP pay rates are *staff-year* rates. However, the difference between end-strength and staff-years for the PEs identified was typically less than 3%, and was positive for some PEs and negative for others. We therefore concluded that the margin of error was inconsequential and would have a negligible effect on the major results of the study.

The costs of the additional medical personnel that we have identified are summarized by Service in Table II-2.[9] The $754 million cost of the additional medical military personnel will turn out to be, by far, the largest adjustment made to the COMA Report in this chapter.

Table II-2. Costs of Additional Medical Personnel (Millions of FY90 Dollars)

	Personnel		Cost	
	Military	Civilian	Military	Civilian
Army	7,192	0	$314.6	$0.0
Navy	10,573	131	$354.7	$4.9
Air Force	1,715	143	$84.4	$4.9
Total	19,480	274	$753.7	$9.8

Finally, we made two checks to determine whether the COMA study had missed any PEs whose missions indicated that they were either fully or partially devoted to medical care. We first looked for omissions from MFP 8 (Training, Medical, and Other General Personnel Activities), the program containing the bulk of medical resources. All of the PEs with medical-related titles and descriptions in the Program Element Dictionary were, indeed, included in the list of PEs we had already identified.

We further examined the fully and partially medical PEs in each Service to determine whether possible PEs with the same number (and title) in the other Services had been included. If Army PE 1234567A was included as a medical PE and there was a Navy PE 1234567N, perhaps it, too, should be included as a medical PE. This check did not reveal any omissions either.

3. Adjusted Pay Rates

As mentioned previously, Military Personnel (MilPers) costs reflected in FYDP PEs, and thus COMA PEs, are based on Service average pay rates. During budget formulation, each Service annually develops one FYDP rate for officers and another for enlisted personnel; each rate is applied as an average over all officer ranks (or enlisted paygrades) as well as all occupational specialties. However, some medical personnel are

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9 We have omitted DoD agencies from Table II-2 and the subsequent tables dealing with manpower adjustments. The medical military personnel in these agencies are all accounted for in the Services' various "Support to ..." PEs. Moreover, we did not identify any additional medical civilians in the DoD agencies.

paid considerably more than the Service-wide average. In an attempt to take this difference into account, we developed an "IDA pay rate," which we used to adjust the MilPers costs of the military medical personnel that we identified from the DMDC database.

The IDA pay rates were constructed by the method illustrated in Table II-3. We began with a set of FY91 medical-personnel pay factors computed by OSD (Health Affairs). These factors are based on tabulations from the Joint Uniformed Military Payroll System (JUMPS) files.[10] The OSD (Health Affairs) factors are available in the following personnel categories: physician, dentist, optometrist, veterinarian, nurse, Medical Service Corps (MSC) officer, and medical enlisted. Unfortunately, no further detail by physician specialty was available. The most important element of these factors is the medical special pay, which, in the case of physicians, is computed as a weighted average over all physician specialties.

Table II-3. Sample Calculation of IDA Medical Pay Rates: Air Force Physician, Rank of Major (O-4)

FY91 OSD (Health Affairs) Rate:			
1. Base Pay	$36,868		
2. Allowances	$11,130		
3. Permanent Change-of-Station (PCS)	$2,966		
4. Other Pays	$365		
5. Retirement Accrual	$15,743		
6. Health-Care Accrual	$3,451		
7. Medical Special Pays (Bonuses)	$38,071		
8. Accession and Training	$12,116		
Total		$120,710	
Reductions:			
PCS	$2,966		
Health-Care Accrual	$3,451		
Accession and Training	$12,116		
Total		$18,533	
Adjusted FY91 OSD Rate			$102,177
Deflation Rate (FY91 to FY90)			0.9565
Adjusted FY90 OSD Rate			$97,732
Employer's FICA Contribution			$3,137
IDA Pay Rate			$100,869

[10] Further documentation is available from Commander D. Sevier, OSD (Health Affairs).

Starting with the medical pay rates developed by OSD (Health Affairs) in FY91, we first eliminated the cost elements "Permanent Change-of-Station (PCS)" and "Accession and Training" because these cost elements are covered by separate PEs in our analysis.[11] Next we eliminated "Health-Care Accrual" because, unlike Retirement Accrual, it is not included in Service FYDP average military pay rates (i.e., this future cost liability is not recognized under current DoD accounting practice). The result was then deflated to FY90 dollars using the Service MilPers deflation factors published by DoD. The final step was to add the FY90 employer's Social Security contribution [under the Federal Insurance Contributions Act (FICA)] which, although a component of the Service average pay rate, was omitted from the OSD (Health Affairs) rate. This figure was provided by the individual Services and represents an *average* contribution for officer and enlisted personnel, as opposed to the actual contribution for a given rank.

The calculations illustrated in Table II-3 were carried out for all Services, medical specialties, and ranks. The detailed results are shown in Appendix B. Table II-4 and Figures II-1 and II-2 show how these IDA pay rates, averaged over the military medical personnel identified from the DMDC database, compare with the FYDP rates, which are averages over *all* military personnel.

Table II-4. Comparison of IDA Medical Pay Rates with FYDP Pay Rates (FY90 Dollars)

	Army	Navy	Air Force
Officers			
IDA	$69,856	$73,834	$69,934
FYDP	$60,548	$63,378	$63,593
Enlisted			
IDA	$26,819	$26,496	$26,551
FYDP	$27,349	$27,620	$28,569
Civilian			
FYDP	$33,052	$37,347	$34,481

Note: The IDA rates are averages over military *medical* personnel. The FYDP rates are averages over *all* military personnel, both medical and non-medical.

[11] The PEs for PCS are 0808731 A, N, M, F, for the Army, Navy, Marine Corps, and Air Force, respectively. These PEs are not listed in Appendix A: they are not COMA PEs, nor are they included in the non-COMA PEs for medical personnel because they contain only costs, not personnel. However, the costs in these PEs (some $233 million) are detailed in the next section, and are included in the totals at the end of this chapter. Finally, the PEs for Accession and Training are included in the listing of COMA fully medical PEs in Appendix A.

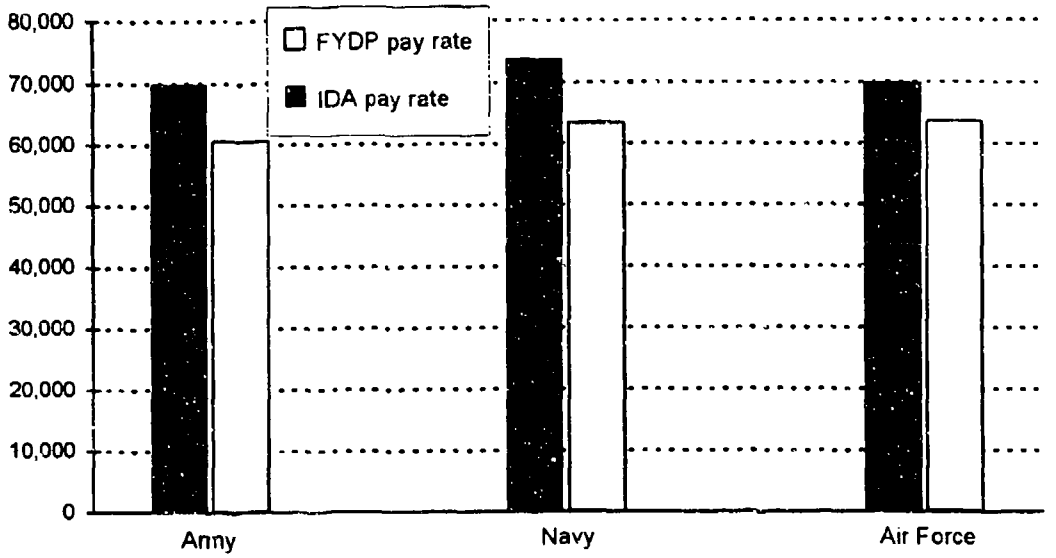

Figure II-1. Comparison of IDA Medical Pay Rates with FYDP Pay Rates, Officers, FY90

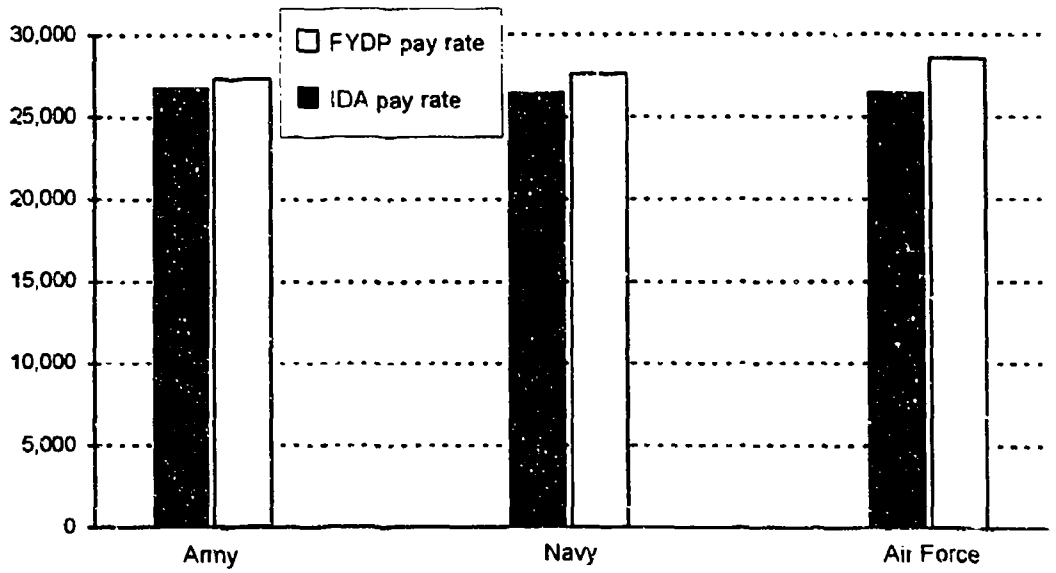

Figure II-2. Comparison of IDA Medical Pay Rates with FYDP Pay Rates, Enlisted Personnel, FY90

The IDA average rates for medical officers are substantially higher than the FYDP rates for the reason mentioned previously, the high bonuses given to physicians, dentists, and other highly-trained medical personnel. The differences are 15%, 17%, and 10% for the three Services, respectively. The pattern is reversed for enlisted personnel, for whom the IDA average rates are lower by 2%, 4%, and 7% for the three Services. The reversal occurs because medical enlisted personnel do not receive aircrew pay, submarine-duty pay, hazardous-duty pay, and sea pay to the same extent as other, non-medical personnel.[12]

The IDA pay rates were applied both to the additional military medical personnel discussed previously, and also to the medical personnel who were assigned, according to the DMDC data, to COMA PEs. The FYDP pay of the non-medical personnel in the COMA PEs was therefore not changed. Nor was the pay adjusted for civilian medical personnel, because there were no medical-specific rates from OSD (Health Affairs) to use as a baseline.

Table II-5 presents a hypothetical illustration of how the IDA pay rates were used to adjust the FYDP MilPers costs, which are calculated using average FYDP pay rates. In an actual application, the numbers of medical personnel would be obtained from the DMDC database, regardless of whether we were analyzing a COMA fully medical PE, a COMA partially medical PE, or a non-COMA PE that contains medical personnel. The FYDP and IDA pay rates in this example both pertain to the Air Force. Multiplying the numbers of medical personnel by the two different pay rates yields the total FYDP and IDA costs, and the difference between these costs is the adjustment shown in the final column. Summing the adjustments over the total numbers of personnel in this illustration yields an upward adjustment $2.1 million. As we mentioned previously, in some instances the IDA pay rates are less than the FYDP rates (reflected in the pay adjustments as negative numbers, shown in parentheses), particularly for the lower paygrades of both officers and enlisted of all Services.

Table II-6 shows the results of performing the calculations illustrated in Table II-5 when using actual DMDC data and the appropriate IDA pay rates for each Service. Although the total adjustment is $278 million, the Service contributions to this

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[12] The pay rate adjustment in this chapter was performed to establish the DoD-wide medical baseline for FY90. A quite different comparison can be made between the IDA pay rates and the rates used in the Medical Expense and Performance Reporting System (MEPRS) to estimate personnel cost at individual military hospitals. The latter comparison is explored further in Chapter III (Table III-5).

total are far from equal. For example, the Navy adjustment is nearly three times as large as the Air Force adjustment, even though the numbers of medical personnel are virtually the same. This disparity arises because fully trained physicians comprise a larger percentage of total medical officers in the Navy (28.2% in FY90) than in the Air Force (23.0%). Thus the difference between the IDA and FYDP pay rates is correspondingly larger for the Navy (about $10,500 for medical officers) than for the Air Force (about $6,300). The overall pay adjustment is largest for the Army, $148 million, reflecting both its large medical force (nearly 60,000 military personnel) and its relatively large adjustment in pay rates ($9,300 for medical officers).

Table II-5. Sample Calculation of Pay Adjustment, Hypothetical Air Force Medical PE

Medical Specialty	Rank	Number of Medical Personnel	Pay Rates ($ FY90)		Total Pay ($ FY90)		Total Pay Adjustment ($ FY90)
			FYDP	IDA	FYDP	IDA	
Physician	O-3	15	$63,593	$66,005	$953,895	$990,075	$36,180
Physician	O-5	47	63,593	115,391	2,988,871	5,423,377	2,434,506
Dentist	O-4	2	63,593	74,791	127,186	149,582	22,396
Veterinarian	O-4	1	63,593	73,130	63,593	73,130	9,537
Nurse	O-2	10	63,593	45,535	635,930	455,350	(180,580)
Nurse	O-3	50	63,593	56,177	3,179,650	2,808,850	(370,800)
Nurse	O-4	35	63,593	69,169	2,225,755	2,420,915	195,160
MSC[a]	O-3	220	63,593	58,207	13,990,460	12,805,540	(1,184,920)
MSC[a]	O-4	145	63,593	71,676	9,220,985	10,393,020	1,172,035
Medical Enlisted	E-4	650	28,569	23,904	18,569,850	15,537,600	(3,032,250)
Medical Enlisted	E-5	606	28,569	28,298	17,312,814	17,148,588	(164,226)
Medical Enlisted	E-6	280	28,569	33,397	7,999,320	9,351,160	1,351,840
Medical Enlisted	E-7	173	28,569	39,072	4,942,437	6,759,456	1,817,019
Total		2,234			$82,210,746	$84,316,643	$2,105,897

a MSC= Medical Service Corps officer.

Table II-6. Adjustment for IDA Pay Rate (Millions of FY90 Dollars)

	Total Military Medical Personnel	Pay at FYDP Rate	Pay at IDA Rate	Dollar Adjustment	Percentage Adjustment
Army	59,350	$2,228.6	$2,376.5	$147.9	6.64%
Navy	42,470	$1,594.5	$1,688.6	$94.1	5.90%
Air Force	43,372	$1,760.0	$1,796.2	$36.2	2.06%
Total	145,192	$5,583.1	$5,861.4	$278.2	4.98%

4. PCS Cost

Although the COMA figures do not include PCS costs, we regard them as a legitimate part of total medical cost. Recall that we removed PCS costs from the calculation of the IDA pay rate. Because PCS costs are included as separate PEs in the FYDP, we included them as an explicit addition to the COMA costs, rather than as a component of pay. We estimated PCS costs by multiplying the number of military medical personnel by the FY90 average military PCS rate for each Service, as reported in the FY92 President's Budget.[13] We did not estimate PCS costs for civilians because there is no average PCS rate for this personnel category. Table II-7 shows the results of our calculations for the individual Services. The total PCS adjustment is just over $233 million.

Table II-7. Adjustment for PCS Cost

	Medical Officers	Medical Enlisted	Officer PCS Rate	Enlisted PCS Rate	Officer PCS Cost ($ FY90 Millions)	Enlisted PCS Cost ($ FY90 Millions)	Total PCS Cost ($ FY90 Millions)
Army	18,236	41,114	$3,465	$1,056	$63.2	$43.4	$106.6
Navy	11,792	30,678	$2,300	$829	$27.1	$25.4	$52.6
Air Force	14,873	28,499	$2,319	$1,388	$34.5	$39.6	$74.0
Total	44,901	100,291			$124.8	$108.4	$233.2

C. SUMMARY OF ADJUSTMENTS

The net effect of the various adjustments is shown by Service in Figure II-3; a breakout of the adjustments by functional category is shown in Figure II-4.[14] Complete detail for each Service is found in Tables II-8 through II-12.

We have confirmed the general level of spending on DoD medical care presented in the COMA report. We estimate that DoD spent approximately $15.6 billion on medical care during FY90, compared to the COMA estimate of $14.1 billion. The difference represents a 10.6% increase over the COMA estimate.

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[13] PCS costs, calculated by this method, represent a *subset* of total spending in the PCS PEs (0808731 A, N, M, F, respectively). These costs are only a subset because the PCS PEs, though located in Major Force Program 8, in fact contain Service-wide totals, not just subtotals for medical personnel.

[14] One category, "Additional Civilian Personnel," is not shown because the total adjustment ($9.8 million) is too small relative to the scale of the chart.

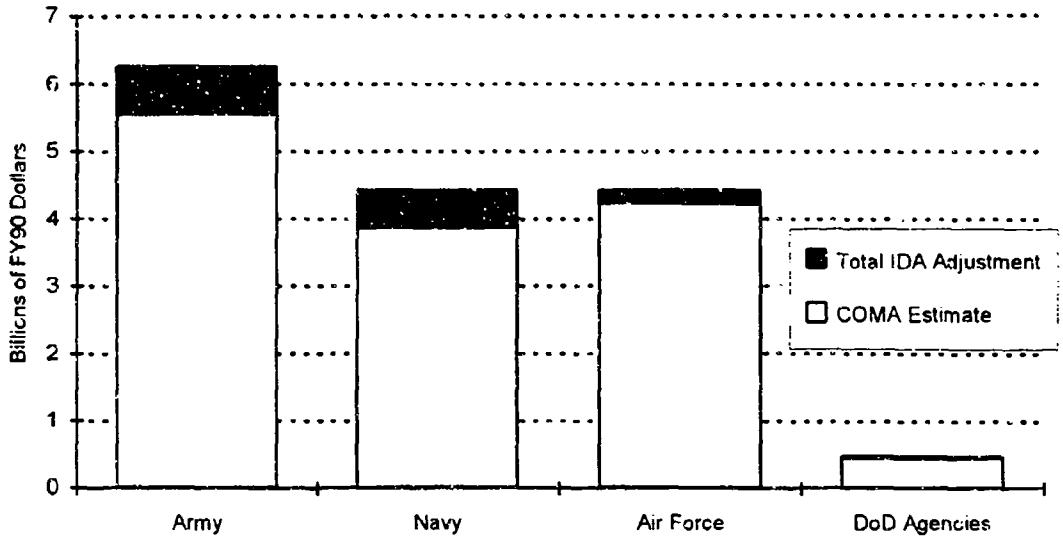
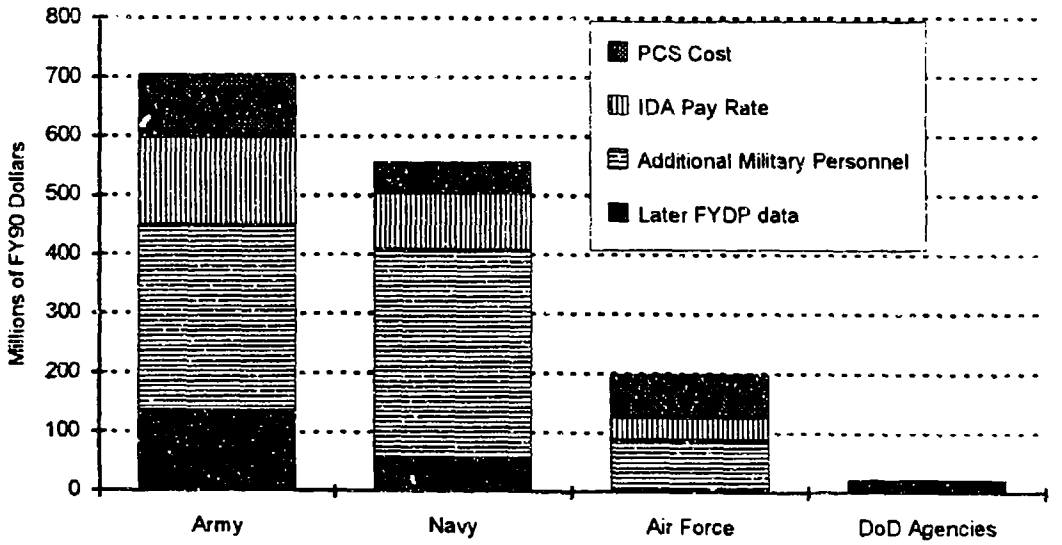


Figure II-3. Summary of IDA Adjustments to FY90 Medical Costs



Note: Additional civilian personnel are not shown because the adjustments were too small to appear given the scale of the chart.

Figure II-4. Detail of IDA Adjustments to FY90 Medical Costs

Table II-8. Total DoD Medical Expenditures (Thousands of FY90 Dollars)

	COMA Cost	Adjustment for Later FYDP Data	Pay Adjustment for Added Medical Military	Pay Adjustment for IDA Medical Pay Rate	Pay Adjustment for Added Medical Civilian	Adjustment for Medical PCS	Total Adjustment	IDA Estimated Medical Cost
MAJOR FORCE PROGRAM								
01 - Strategic Forces			$16,201	$2,318	$103		$18,622	$18,622
02 - General Purpose Forces	$732,075	$41,373	$300,558	($10,494)	$1,207		$332,644	$1,064,719
03 - Intelligence and Communications	$4,375		$6,709	$505	$172		$7,386	$11,761
04 - Airlift and Sealift Forces	$5,594		$4,538	$1,087	$138		$5,763	$11,357
05 - Guard and Reserve Forces	$280,166	$40,886	$29,224	$6,145			$76,255	$356,421
06 - Research and Development	$367,120	($7,847)	$18,877	$16,237	$5,064		$32,331	$399,451
07 - Central Supply and Maintenance	$1,559		$13,180	$3,222	$2,931		$19,333	$20,892
08 - Training, Medical, and Other General Personnel Activities	$12,481,207	$350,815		$241,318		$233,205	$825,338	$13,306,545
09 - Administration and Associated Activities	$9,588		$54,321	$11,024	$34		$65,379	$74,967
10 - Support of Other Nations			$2,765	$308	$69		$3,142	$3,142
11 - Special Operations Forces			$6,784	$997	$103		$7,884	$7,884
Subtotal	$13,881,684	$425,227	$453,157	$272,667	$9,823	$233,205	$1,394,079	$15,275,763
NON-PROGRAM SPECIFIC								
Other Procurement	$207,818	($207,818)					($207,818)	
Medical Personnel			$300,566	$5,581			$306,147	$306,147
Subtotal	$207,818	($207,818)	$300,566	$5,581			$98,329	$305,147
TOTAL DoD MEDICAL COST	$14,089,502	$217,409	$753,723	$278,248	$9,823	$233,205	$1,492,408	$15,581,910

Table II-9. Army Medical Expenditures
(Thousands of FY90 Dollars)

	COMA Cost	Adjustment for Later FYDP Data	Pay Adjustment for Added Medical Military	Pay Adjustment for IDA Medical Pay Rate	Pay Adjustment for Added Medical Civilian	Adjustment for Medical PCS	Total Adjustment	IDA Estimated Medical Cost
MAJOR FORCE PROGRAM								
01 - Strategic Forces	$709,746	$41,373		($20,367)			$21,006	$730,752
02 - General Purpose Forces	$4,375		$1,198	$14			$1,212	$5,587
03 - Intelligence and Communications								
04 - Airlift and Sealift Forces	$31,318	$38,749	$10,966	$623			$50,338	$81,656
05 - Guard and Reserve Forces	$291,030	($6,550)	$82	$9,108			$2,640	$293,670
06 - Research and Development			$2,378	$571			$2,949	$2,949
07 - Central Supply and Maintenance	$4,441,183	$130,824		$153,287		$106,604	$390,715	$4,831,898
08 - Training, Medical, and Other General Personnel Activities	$6,834		$4,533	$99			$4,632	$11,466
09 - Administration and Associated Activities			$61	($16)			$45	$45
10 - Support of Other Nations			$61	($16)			$45	$45
11 - Special Operations Forces	$5,484,486	$204,396	$19,279	$143,303		$106,604	$473,582	$5,958,068
Subtotal								
NON-PROGRAM SPECIFIC								
Other Procurement	$68,635	($68,635)					($68,635)	
Medical Personnel			$295,306	$4,656			$299,962	$299,962
Subtotal	$68,635	($68,635)	$295,306	$4,656			$231,327	$299,962
TOTAL ARMY MEDICAL COST	$5,553,121	$135,761	$314,585	$147,959		$106,604	$704,909	$6,258,030

Table II-10. Navy Medical Expenditures
(Thousands of FY90 Dollars)

	COMA Cost	Adjustment for Later FYDP Data	Pay Adjustment for Added Medical Military	Pay Adjustment for IDA Medical Pay Rate	Pay Adjustment for Added Medical Civilian	Adjustment for Medical PCS	Total Adjustment	IDA Estimated Medical Cost
MAJOR FORCE PROGRAM								
01 - Strategic Forces			$11,748	$1,439			$13,187	$13,187
02 - General Purpose Forces			$280,226	$6,224			$286,450	$286,450
03 - Intelligence and Communications			$1,816	$331			$2,147	$2,147
04 - Airlift and Sealift Forces	$5,509			$405			$405	$5,914
05 - Guard and Reserve Forces	$118,831		$17,826	$5,236			$23,062	$141,893
06 - Research and Development	$38,823	($111)	$18,795	$4,767	$4,892		$28,343	$67,166
07 - Central Supply and Maintenance	$1,559		$3,301	$898			$4,199	$5,758
08 - Training, Medical, and Other General Personnel Activities	$3,654,875	$98,703		$68,940		$52,554	$220,199	$3,875,074
09 - Administration and Associated Activities			$12,169	$4,137			$16,306	$16,306
10 - Support of Other Nations			$301	$66			$367	$367
11 - Special Operations Forces			$5,935	$945			$6,880	$6,880
Subtotal	$3,819,597	$98,594	$352,117	$93,388	$4,892	$52,554	$601,545	$4,421,142
NON-PROGRAM SPECIFIC								
Other Procurement	$43,469	($43,469)					($43,469)	
Medical Personnel			$2,602	$725			$3,327	$3,327
Subtotal	$43,469	($43,469)	$2,602	$725			($40,142)	$3,327
TOTAL NAVY MEDICAL COST	$3,863,066	$55,125	$354,719	$94,113	$4,892	$52,554	$561,403	$4,424,469

Table II-11. Air Force Medical Expenditures (Thousands of FY90 Dollars)

MAJOR FORCE PROGRAM	COMA Cost	Adjustment for Later FYDP Data	Pay Adjustment for Added Medical Military	Pay Adjustment for IDA Medical Pay Rate	Pay Adjustment for Added Medical Civilian	Adjustment for Medical PCS	Total Adjustment	IDA Estimated Medical Cost
01 - Strategic Forces			$4,453	$879	$103		$5,435	$5,435
02 - General Purpose Forces	$22,329		$20,332	$3,649	$1,207		$25,188	$47,517
03 - Intelligence and Communications			$3,695	$160	$172		$4,027	$4,027
04 - Airlift and Sealift Forces	$85		$4,538	$682	$138		$5,358	$5,443
05 - Guard and Reserve Forces	$130,017	$2,137	$432	$286			$2,855	$132,872
06 - Research and Development	$35,079	($1,180)		$2,362	$172		$1,354	$36,433
07 - Central Supply and Maintenance			$7,501	$1,753	$2,931		$12,185	$12,185
08 - Training, Medical, and Other General Personnel Activities	$3,933,772	$99,251		$19,091		$74,047	$192,389	$4,126,161
09 - Administration and Associated Activities	$2,754		$37,619	$6,788	$34		$44,441	$47,195
10 - Support of Other Nations			$2,403	$258	$69		$2,730	$2,730
11 - Special Operations Forces			$788	$68	$103		$959	$959
Subtotal	$4,124,036	$100,208	$81,761	$35,976	$4,931	$74,047	$296,923	$4,420,959
NON-PROGRAM SPECIFIC								
Other Procurement	$95,714	($95,714)					($95,714)	
Medical Personnel			$2,658	$200			$2,858	$2,858
Subtotal	$95,714	($95,714)	$2,658	$200			($92,856)	$2,858
TOTAL AIR FORCE MEDICAL COST	$4,219,750	$4,494	$84,419	$36,175	$4,931	$74,047	$204,067	$4,423,817

Table II-12. DoD Agencies Medical Expenditures (Thousands of FY90 Dollars)

	COMA Cost	Adjustment for Later FYDP Data	Pay Adjustment for Added Medical Military	Pay Adjustment for IDA Medical Pay Rate	Pay Adjustment for Added Medical Civilian	Adjustment for Medical PCS	Total Adjustment	IDA Estimated Medical Cost
MAJOR FORCE PROGRAM								
01 - Strategic Forces								
02 - General Purpose Forces								
03 - Intelligence and Communications								
04 - Airlift and Sealift Forces								
05 - Guard and Reserve Forces								
06 - Research and Development	$2,188	($6)					($6)	$2,182
07 - Central Supply and Maintenance								
08 - Training, Medical, and Other General Personnel Activities	$451,377	$22,035					$22,035	$473,412
09 - Administration and Associated Activities								
10 - Support of Other Nations								
11 - Special Operations Forces								
Subtotal	$453,565	$22,029					$22,029	$475,594
NON-PROGRAM SPECIFIC								
Other Procurement								
Medical Personnel								
Subtotal								
TOTAL DoD AGENCIES MEDICAL COST	$453,565	$22,029					$22,029	$475,594

As one might expect, most of the medical spending occurs in MFP 8 (Training, Medical, and Other General Personnel Activities). Approximately $13.3 billion was spent in this program, or 85% of the adjusted medical total of $15.6 billion (see Table II-8). The COMA report estimated a higher percentage of spending, 89%, in MFP 8, because the COMA methodology did not recognize as many medical resources in PEs outside of MFP 8. For example, our estimate of medical spending in MFP 2 (General Purpose Forces) exceeds the COMA estimate by $333 million.

By functional category (Figure II-4), the largest adjustment to the COMA figures is the addition of the MilPers cost of medical personnel not recognized in the COMA. These personnel cost $754 million when priced at the FYDP average pay rates. In addition, these personnel account for a portion of the pay adjustment of $278 million, which reflects the difference between the IDA and FYDP pay rates. Finally, the DoD-wide adjustment for the later FYDP data is $217 million, and the adjustment for medical PCS is $233 million.

III. MEPRS AND OTHER DATA SOURCES

In order to compare the cost-effectiveness of in-house medical care with that of medical care purchased from the civilian sector, the same set of cost elements must be included on both sides of the ledger. Prices charged by civilian-sector providers reflect all elements of cost, including corporate overhead, inter-divisional transfer, and amortization of real property. We used the Medical Expense and Performance Reporting System (MEPRS) as our primary data source on cost and workload at Military Treatment Facilities (MTFs). This chapter first provides a general description of MEPRS. Because MEPRS was designed for a different purpose than were commercial cost-accounting systems, some cost elements are missing from MEPRS. We develop adjustments to fill the gap left by these missing cost elements. The adjustments developed in this chapter are critical to allow a fair comparison with medical costs charged in the civilian sector.

We made every effort to be conservative in developing the adjustments to MEPRS. That is, we included additional cost elements only when we could clearly justify them as comparable to costs charged in the civilian sector. Moreover, we included cost elements only when we could clearly identify them with DoD's peacetime health-care mission, as opposed to its wartime readiness mission. Having made the MEPRS adjustments, we assess their impact by comparing the reported and adjusted costs for FY92. Finally, we close the chapter by identifying the sources for the few remaining data elements outside of MEPRS.

A. MEPRS COST AND WORKLOAD DATA

According to the MEPRS manual:[1]

> The purpose of the Medical Expense and Performance Reporting System (MEPRS) for DoD Medical Operations is to provide consistent principles, standards, policies, definitions, and requirements for accounting and

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1 "Medical Expense and Performance Reporting System for Fixed Military Medical and Dental Treatment Facilities," Office of the Assistant Secretary of Defense (Health Affairs). Publication DoD 6010.13M, January 1991, p. 1.3.

reporting of expense, manpower, and performance by DoD fixed military medical facilities. Within these specific objectives the MEPRS also provides in detail: uniform performance indicators; common expense classification by work centers; uniform reporting of personnel utilization data by work centers; and a cost assignment methodology.

Before describing in detail what MEPRS *is*, it is useful to describe what MEPRS is *not*. First, MEPRS is *not* the hospital commander's annual budget. Some cost elements in MEPRS are "non-reimbursable" meaning that, although the hospital makes a cost estimate, no funds are actually spent from the hospital commander's budget. Instead, the hospital receives services "free," usually from the host military base. Examples include fire and police protection and snow removal provided by the host base. Similarly, MEPRS entries for depreciation do not represent current-year outlays. The link between MEPRS expenses and Future Years Defense Program (FYDP) obligations is further clouded because, depending on the type of appropriation, obligated funds may translate into outlays (and thus appear in MEPRS) over a multi-year time window. None of these observations are intended as pejorative, because MEPRS was designed for a different purpose than the budgeting system.

Along these lines, it is critical to recognize that MEPRS is *not* a patient-level cost-accounting system: MEPRS *cannot* be used to directly estimate the cost of performing a particular procedure on a particular patient. The DoD has not yet seen the need to develop a patient-level accounting system, because patients are not billed individually for medical services provided in-house. Although this observation may appear startling at first, we should point out that Kaiser Permanente (a civilian Health Maintenance Organization) does not bill patients individually either, nor do they have a patient-level accounting system. Instead, they set premiums for large groups of patients by relating aggregate cost experience to summary demographic and epidemiological characteristics.

Given these limitations, we will now describe procedures for indirectly estimating unit cost at MTFs (i.e., cost per inpatient discharge or cost per ambulatory visit) based on MEPRS data. MEPRS reports cost and workload within a three-digit hierarchical chart of accounts. The entire set of one-digit account codes is shown in Table III-1, along with an illustrative partial set of two-digit and three-digit account codes. Costs are available at any of these three levels of aggregation: the two-digit cost is the sum of its constituent three-digit costs; similarly, the one-digit cost is the sum of its constituent two-digit costs. Our regression modeling was conducted at the one-digit level of aggregation (e.g., Inpatient

and Ambulatory). However, we examined costs down to the three-digit level in order to better understand the data system, and to develop adjustment factors where necessary.

Table III-1. Partial List of MEPRS Account Codes

MEPRS Account Code	Account Title	Status
A	Inpatient	final operating account
AA	Medical Care	final operating account
AAA	Internal Medicine	final operating account
AAB	Cardiology	final operating account
AAC	Coronary Care	final operating account
AAD	Dermatology	final operating account
AAE	Endocrinology	final operating account
AAF	Gastroenterology	final operating account
AAG	Hematology	final operating account
AAH	Intensive Care	final operating account
AAI	Nephrology	final operating account
AAJ	Neurology	final operating account
AAK	Oncology	final operating account
AAL	Pulmonary	final operating account
AAM	Rheumatology	final operating account
AAN	Physical Medicine	final operating account
AAO	Clinical Immunology	final operating account
AAP	HIV (AIDS)	final operating account
AAQ	Bone Marrow Transplant	final operating account
AAR	Infectious Disease	final operating account
AAS	Allergy	final operating account
AB	Surgical Care	final operating account
AC	Obstetrical/Gynecological Care	final operating account
AD	Pediatric Care	final operating account
AE	Orthopedic Care	final operating account
AF	Psychiatric Care	final operating account
AG	Family Practice Care	final operating account
B	Ambulatory	final operating account
C	Dental	final operating account
D	Ancillary	**intermediate operating account**
E	Support	**intermediate operating account**
F	Special Programs	final operating account

The Ancillary and Support accounts are labeled "intermediate operating accounts," indicating that the costs are "stepped-down" or allocated to the final operating accounts. For example, costs in ancillary account DFA (Anesthesiology) are stepped-down to the final operating accounts based on the minutes of service provided to each receiving

account. Similarly, costs in support account EFA (Housekeeping) are stepped-down based on the square footage cleaned for each receiving account. The final operating accounts are available from MEPRS in both pre- and post-stepdown form, so that one can retrieve the Ancillary and Support subtotals associated with each final operating account. However, it is extremely difficult to determine the particular Ancillary and Support accounts that comprise these subtotals.

MEPRS includes costs in four major categories: materials, supplies, depreciation, and personnel. Materials and supplies should be interpreted broadly to include all non-personnel Operations and Maintenance expenses funded through the following program elements: 0807711 (Care in Regional Defense Facilities), 0807714 (Other Medical Activities), 0807715 (Dental Care Activities), 0807790 (Audio-Visual Activities, Medical), and 0807792 (Station Hospitals and Clinics).[2]

MEPRS includes a depreciation allowance for purchases, funded through the Other Procurement appropriation, of modernization and replacement equipment in excess of a dollar threshold. The threshold is increased periodically to reflect price inflation. Depreciation is taken on a straight-line basis over eight years. Depreciation allowances are assigned as indirect expenses during the step-down process, rather than being directly assigned to a work center upon acquisition.

Personnel are classified by skill category: clinicians (i.e., physicians and dentists), direct-care professionals, direct-care paraprofessionals, registered nurses, and administrative/clerical/logistical personnel. Personnel are further classified by type: officer, enlisted, civilian, contract, and other. Timesheets are used to allocate personnel time across three-digit MEPRS accounts. Within each three-digit account, personnel expenses are then estimated by multiplying full-time equivalents (FTEs) times standard pay factors. These pay factors differ from the FYDP pay factors discussed in Chapter II; these differences will be explored later in this chapter.

Each three-digit MEPRS account has its own measure of workload performed. As already indicated, the D (Ancillary) and E (Support) accounts have workload measures, such as square feet, that facilitate stepping-down their costs to the final operating accounts.

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2 See "Medical Expense and Performance Reporting System for Fixed Military Medical and Dental Treatment Facilities," p. 3.6.

The workload measures for the A (Inpatient) accounts are dispositions and occupied bed days. The workload measure for the B (Ambulatory) accounts is the number of visits.

B. ADJUSTMENTS TO MEPRS COST DATA

We made several adjustments for cost elements that are undercounted or, in some cases, completely ignored in MEPRS. We made these adjustments to allow a fair comparison with medical costs charged in the civilian sector, recognizing that MEPRS was not designed to include all of the cost elements found in commercial cost-accounting systems. Many of the adjustments were based on a side-by-side comparison between subsets of MEPRS and corresponding subsets of the FYDP. Other adjustments relied upon comparisons between MEPRS data for the three Services, with one Service acting as the benchmark for the other two. This section develops and justifies the various adjustments that were made, based primarily on FY90 MEPRS data.

1. Base Operations and Real Property Maintenance

Of the MTFs in the continental United States (CONUS), all but seven reside on a host military base. The seven stand-alone MTFs are: Walter Reed Army Medical Center (AMC), Fitzsimons AMC, National Naval Medical Center (NNMC) Bethesda, Naval Hospital (NH) Oakland, NH Portsmouth, NH San Diego, and NH Beaufort. For all but these seven, a considerable portion of base operations and real property maintenance activity (RPMA) is provided by the host base. Among the services provided by the host base are: utilities, property maintenance, minor construction, transportation, and fire and police protection. The purpose of this section is to determine whether support services provided by the host base are adequately reflected in MEPRS, or whether some adjustment is necessary.

Base operations and RPMA are reflected in MEPRS in one of three ways. If the hospital transfers funds to the host base in return for services provided, then the services are deemed "reimbursable." The amount of money transferred appears in the two-digit ED account of MEPRS (Support Services, Funded or Reimbursable). If the hospital receives services but does not transfer any funds, then the services are deemed "non-reimbursable." In this instance, the hospital estimates the value of services received, and reports the estimate in the EC account of MEPRS (Support Services, Non-reimbursable). Although the basis for the estimate varies by detailed three-digit cost element, the most common basis is the number of square feet within the hospital. Finally, housekeeping costs are

sometimes grouped together with base operations and RPMA. Military hospitals pay for all of their own housekeeping, and these costs are reported in the EF account of MEPRS (Housekeeping).

The Defense Business Operations Fund (DBOF) was introduced, though not fully implemented, in FY92. The effect of DBOF is to make more support services reimbursable. Hence, the more recent data should show more costs in the ED and EF accounts and fewer costs in the EC accounts. However, the EC accounts were still used quite extensively in FY90. Therefore, we must assess the estimates that hospitals made of the value of support services received from their host bases.

a. Comparison Among the Three Services

Officials in the Naval Bureau of Medicine and Surgery (BuMed) indicated that Naval Hospitals pay essentially all of their own base operations and RPMA. Similarly, officials in the Air Force Office of the Surgeon General indicated that Air Force Hospitals pay essentially all costs within a 50-foot radius of the hospital. By contrast, most base operations and RPMA were *not* considered reimbursable by Army hospitals during FY90. For the Army, therefore, the majority of these costs should appear as estimates in the EC accounts of MEPRS.

There is a *prima facie* case that reporting of base operations and RPMA is more accurate and comprehensive for the Navy and the Air Force than for the Army. The Navy and Air Force report funds actually transferred, whereas the Army relies on estimates of the value of support services received. Figure III-1 provides some evidence on this hypothesis. The figure displays support-service costs as a fraction of total "direct" MEPRS costs. More specifically, the numerator is the sum of MEPRS expenses in accounts EC, ED, and EF, world-wide for all MTFs in FY90. The denominator is the sum of MEPRS expenses in accounts A (Inpatient), B (Ambulatory), C (Dental), and F (Special Programs). The latter are the broad clinical accounts that are supported by reimbursable and non-reimbursable expenses.

As expected, the Navy and the Air Force show much larger proportions of reimbursable (ED) than non-reimbursable (EC) expenses. In addition, the ratio of support to direct costs is nearly equal for these two Services, perhaps indicating that both are reporting costs comprehensively.

Also as expected, the Army shows a much larger proportion of non-reimbursable support expenses (EC). The surprising feature is the magnitude of the EC account: about 4.3% of total direct costs. In combination, the EC, ED, and EF accounts for the Army sum to 7.4% of total direct costs, a figure nearly comparable to that observed for the Navy and the Air Force. If we accept the latter two Services as a benchmark, then the Army estimates may be reasonable.

Further evidence is provided by Figure III-2, which presents an average over the four-year period, FY87-FY90. The ratios for the three Services are nearly identical when viewed over this longer time horizon. We conclude that the Army support-cost ratios require no adjustment relative to the Navy and the Air Force.

b. Comparison Between MEPRS and the FYDP

A different perspective is obtained by comparing MEPRS data not among the Services, but rather to the corresponding Program Elements (PEs) in the FYDP. Real property maintenance for military hospitals is funded in PE 0807794, and base operations are funded in PE 0807796.[3] The Army FYDP data are of limited use in this comparison, because PE 0807796 funded only three sites during FY90: Walter Reed AMC, Fitzsimons AMC, and Fort Detrick.[4]

The Air Force data are of much greater interest in this regard, because Air Force Regulation 170-5 (15 May 1992) provides a cross-walk between MEPRS clinical accounts and the PEs from which they are funded. For example, each three-digit MEPRS code beginning with A (Inpatient), B (Ambulatory), or D (Ancillary) maps into two admissible PEs: 0807711 (Care in Regional Defense Facilities) and 0807792 (Station Hospitals and Medical Clinics). Similarly, each three-digit MEPRS code beginning with C (Dental) maps into PE 0807715 (Dental Care Activities).

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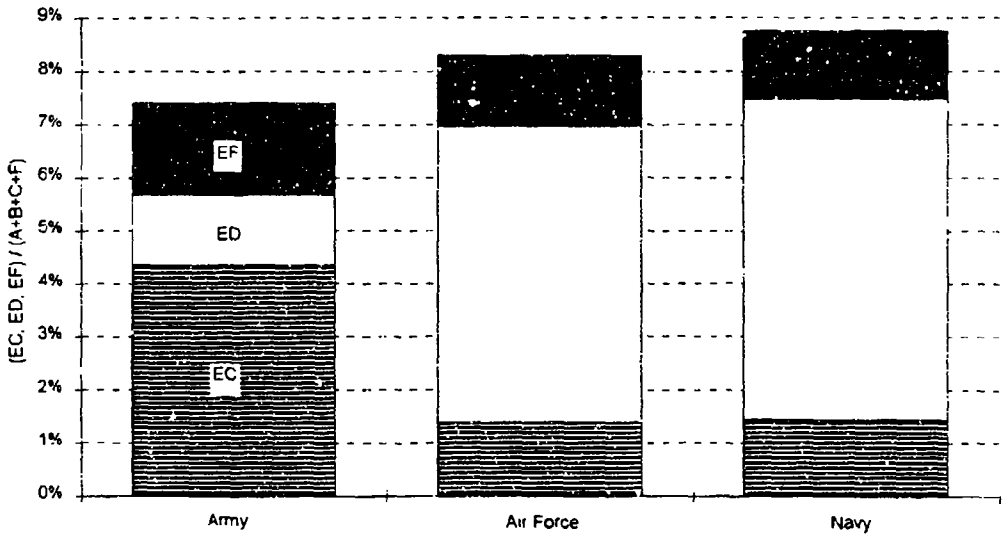
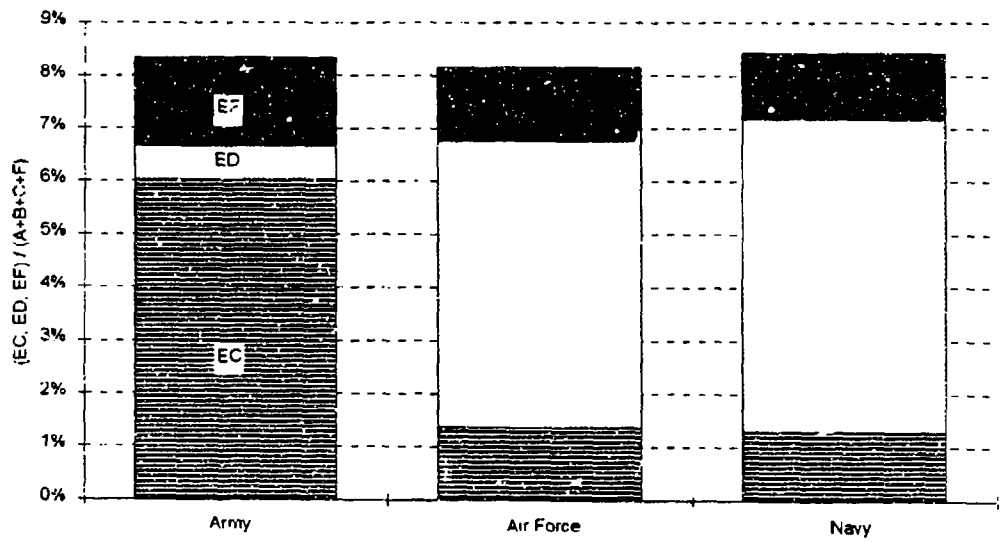
[3] An exception is that the Air Force does not use PE 0807796; instead, both base operations and RPMA are combined into the single PE 0807794.

[4] Fort Detrick, Maryland, is not an MTF, but is a stand-alone facility providing automation support and other services to the DoD medical community.



Note: EC =non-reimbursable expenses, ED=reimbursable expenses, and EF=directly funded expenses.

Figure III-1. Support Accounts as a Percentage of Direct Accounts: MEPRS, FY90



Note: EC=non-reimbursable expenses, ED=reimbursable expenses, and EF=directly funded expenses.

Figure III-2. Support Accounts as a Percentage of Direct Accounts: MEPRS, FY87-FY90

The regulation also indicates the three-digit MEPRS accounts that map into the PE 0807794. If all the obligated funds are faithfully reported in MEPRS, then the MEPRS subtotal in these accounts should equal the FYDP obligation in PE 0807794. Table III-2 indicates that the MEPRS subtotal and the FYDP obligation were remarkably close in FY90, differing by about $2 million or less than 2%. Therefore, the Air Force support-cost ratio, shown previously in Figures III-1 and III-2, indeed appears to be an adequate benchmark for the other two Services. In light of the similarity in support-cost ratios across the three Services, we concluded that MEPRS requires no adjustment for base operations or RPMA.

Table III-2. Comparison of Air Force Support Accounts, FY90

MEPRS Code	Account title	MEPRS Expenses	FYDP Operations and Maintenance (O&M) Obligations (PE 0807794)
EDB	Funded Operation of Utilities	$37,324,181	
EDC	Funded Maintenance of Real Property	$39,950,243	
EDD	Funded Minor Construction	$14,112,953	
EDE	Funded Other Engineering Support	$8,534,615	
EDF	Funded Lease of Real Property	$395,866	
EFA	In-house Housekeeping	$760,089	
EFB	Contract Housekeeping	$30,562,408	
Subtotal		$131,640,355	$129,410,000

2. Management Headquarters

For comparability with prices charged in the civilian sector, the cost of military medicine should include a component for management headquarters. This component includes the three Service Surgeons General and their immediate headquarters staffs. A comparable cost in the civilian sector might be, for example, the regional headquarters for Kaiser Permanente. This cost would be passed along to customers in the prices charged by civilian-sector providers.

Costs for management headquarters are not reported in MEPRS, but an estimate may be made from FYDP data. Program element 0807798 contains FYDP obligations for Management Headquarters, Medical. This PE showed $21.7 million each for the Army and the Navy in FY90. The Air Force did not report any obligations in this PE in FY90. Although the management-headquarters function is certainly present in the Air Force, it is not visible in the FYDP.

We have charged the Air Force $21.7 million for management headquarters, precisely the amount reported by the other two Services in the FY90 FYDP. The MEPRS totals for that year are displayed in Figure III-3, by Service and one-digit MEPRS account. The Army had the highest MEPRS total, followed by the Air Force and then the Navy. The headquarters allocation of $21.7 million amounts to 0.68% of the Army MEPRS total of $3.173 billion, and 1.11% of the Navy MEPRS total of $1.948 billion. The Air Force is bracketed between the other two Services, with the headquarters allocation representing 0.85% of its MEPRS total of $2.548 billion.

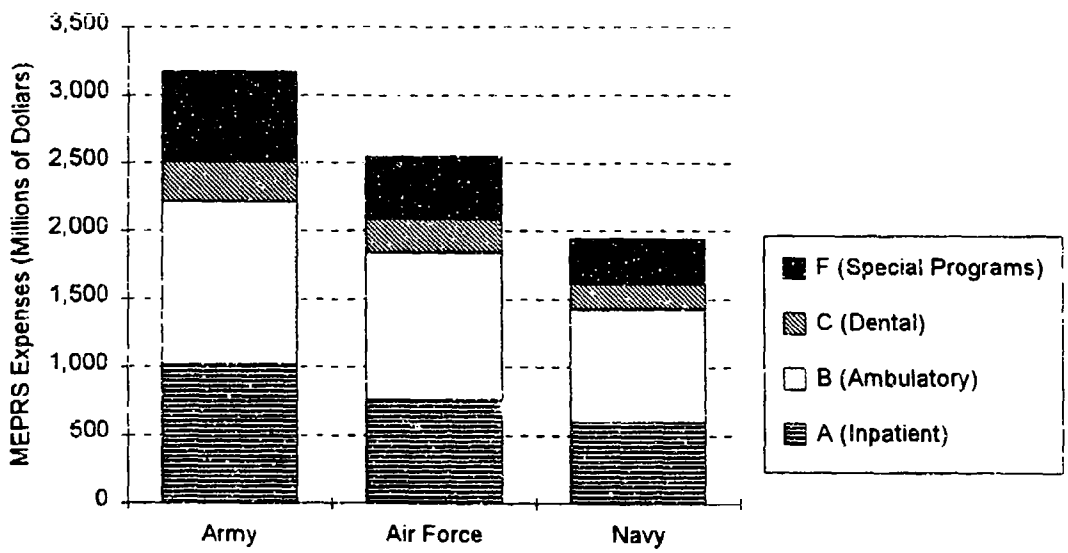


Figure III-3. FY90 MEPRS Expenses, by Service and Functional Category

3. Facilities Construction Allowance

Civilian-sector medical prices include an amortization for facilities construction. However, there is no corresponding cost element in MEPRS.[5] The purpose of this subsection is to develop a facilities construction allowance, again with the goal of making costs comparable between the military and civilian sectors. The remainder of this subsection describes three approaches to developing a facilities construction allowance; the first two approaches are merely summarized here, and are developed more fully in Appendix C. Based on these three approaches, our best estimate of the construction allowance is 4.3% of MEPRS operating expense.

a. Economic Analyses of Hypothetical Military Hospitals

As described in Appendix C, economic analyses were examined for the construction of 14 hypothetical military hospitals. Multiple scenarios were available for some of the hospitals, yielding a total of 37 construction scenarios. Under each scenario, the hospital was designed to serve a specified annual workload. Engineering estimates were then made of both initial construction costs and recurring operating costs necessary to service each hypothetical workload. Construction costs include the following elements: new building construction, initial medical equipment, supporting facilities, contingencies, plus allowances for supervision, inspection, and overhead. The engineering estimates of operating cost correspond roughly to the total of the A (Inpatient), B (Ambulatory), C (Dental), and F (Special Programs) accounts of MEPRS. In particular, the C and F accounts were included in the cost basis because construction costs support all of these activities, not just inpatient and ambulatory care. Among the operating cost elements included are: physician salaries, supporting staff salaries, supplies, ancillary procedures, and support (e.g., base operations, RPMA, and housekeeping).

It would be unreasonable to charge the entire construction cost against a single year's operating budget. Instead, the construction cost was amortized over the notional lifetime of the facility. Ranges were considered for both the real interest rate and the notional facility lifetime. The relationship between amortized construction costs and

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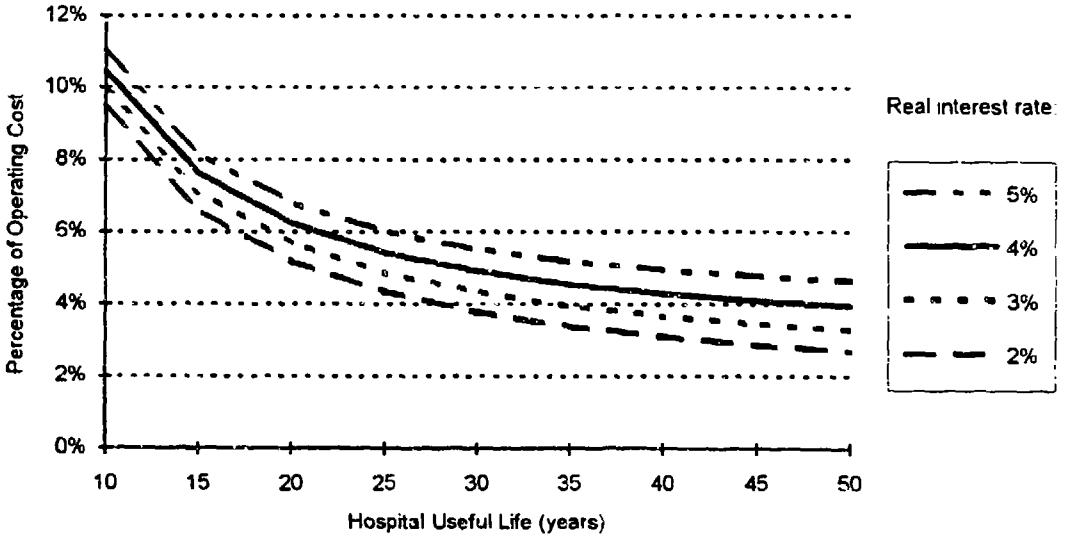
[5] The EA account of MEPRS contains a depreciation allowance for modernization and replacement equipment. However, MEPRS does not contain any estimate of depreciation associated with: (1) new and expanded facilities, (2) real property installed equipment (such as environmental control units and elevators), or (3) war readiness material. See "Medical Expense and Performance Reporting System for Fixed Military Medical and Dental Treatment Facilities," p. 2E-4.

annual operating costs was found to be the same for both community hospitals and medical centers. This relationship is depicted in Figure III-4.



Note: Operating cost corresponds to MEPRS A (Inpatient), B (Ambulatory), C (Dental), and F (Special Programs) accounts.

Figure III-4. Amortized Construction Cost as a Percentage of Annual Operating Cost (at Various Real Interest Rates)

For long lifetimes, the four curves are essentially proportional to the real interest rate. Although a range of interest rates was considered, the preferred estimate uses a real annual rate of 3.8%, roughly the historical average yield on 30-year government bonds. The amortization curves flatten out beyond a useful life of about 35 years. Medicare's capital-cost reimbursement system uses an estimated 40-year lifetime, and we believe this estimate to be appropriate for military hospitals as well. The combination of a 40-year lifetime and a 3.8% real interest rate yields a construction-cost adjustment equal to 4.3% of MEPRS operating expense.

b. Comparison of Hospital Size and Historical Operating Costs

The second approach, also described in Appendix C, uses actual FY90 MEPRS operating costs, as opposed to engineering estimates based on hypothetical annual workloads. Similarly, the construction-cost estimates are obtained by multiplying actual

square footage of 87 CONUS hospitals and 17 medical centers, by official DoD estimates of construction cost per square foot.[6]

The construction-cost estimates were amortized over a 40-year lifetime at a 3.8% real interest rate. The ratio of amortized construction costs to MEPRS operating costs provides an alternative estimate of the construction-cost adjustment factor. This procedure yielded an estimate of 4.2 percent. It is encouraging that this estimate, computed using entirely different data sources, is so close to the previous estimate of 4.3 percent.

c. Analysis of FYDP Military Construction Appropriations

Finally, a construction-cost adjustment factor may be estimated by analyzing military-construction appropriations in the FYDP. Of course, construction appropriations for a single fiscal year do not correspond to operating expenses for that same year. Instead, the existing inventory consists of facilities that were built in many previous years. In principle, the construction cost of each individual facility could be separately identified in the historical data, then adjusted to constant dollars after correcting for inflation, depreciation, obsolescence, major maintenance and renovation, and so on.

Because the requisite historical data are difficult to obtain, we pursued a much less ambitious and more approximate approach. We obtained data on FY89 through FY92 construction projects from the Defense Medical Facilities Office (DMFO). That office divides construction projects into four categories: (1) minor construction, projects smaller than $300,000; (2) unspecified minor construction (UMC), projects between $300,000 and $1.5 million; (3) major construction, projects larger than $1.5 million, which are line-item authorized; and (4) planning and design (P&D), which is not separately identified by Service.[7] At our request, the DMFO also divided construction projects into those relating to peacetime health-care, and those relating to wartime-contingency facilities. Table III-3

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[6] The construction cost estimates are contained in: "Area Cost Factors and Unit Prices for FY 1994-1995 Department of Defense Facilities Construction," Tri-Service Committee on Cost Engineering, Office of the Assistant Secretary of Defense (Production and Logistics), July 1992. In addition to facilities construction (i.e., brick and mortar), these estimates include an allowance for initial equipment to be used in both inpatient and ambulatory care.

[7] There is a separate Program Element for P&D, 0807716D (Medical Facilities, Planning and Design). The other categories of construction are funded through Program Element 0807717D (Medical Facilities, Military Construction). In each case, the "D" suffix indicates that these are OSD, rather than Service, Program Elements.

summarizes the DMFO data on categories (2) through (4).[8] Note that major construction is reported separately by Service, whereas UMC and P&D are combined in the far right column of the table.

Table III-3. DMFO Major Construction and P&D/UMC Projects (Millions of Then-Year Dollars)

	Army		Air Force		Navy		
Fiscal Year	Peacetime	Total	Peacetime	Total	Peacetime	Total	P&D + UMC
1989	143.7	143.7	92.7	107.9	33.4	52.9	30.6
1990	102.0	103.5	29.2	29.2	56.7	74.7	45.7
1991	77.2	77.2	61.7	61.7	63.0	69.5	47.0
1992	64.6	64.6	30.5	33.5	119.6	141.6	46.2
Four-Year Average:	96.9		53.5		68.2		

Note: P&D = planning and design, UMC = unspecified minor construction.

The military-construction appropriations show wide year-to-year variations. In an attempt to smooth the data, we computed the four-year average of the peacetime-related projects. The Army average of $96.9 million amounts to 3.1% of the Army MEPRS total of $3.173 billion in FY90. The Air Force average of $53.5 million amounts to 2.1% of the Air Force MEPRS total of $2.548 billion. Finally, the Navy average of $68.2 million represents 3.5% of the Navy MEPRS total of $1.948 billion.

These factors are smaller than those computed by the first two methods. We consider this last method to be the least reliable of the three, because the volatile military-construction appropriations for FY89 through FY92 need not reflect the replacement costs for facilities already in place during that time period. We believe our best estimate of the construction allowance is 4.3% of MEPRS operating expense, based on the first method discussed.

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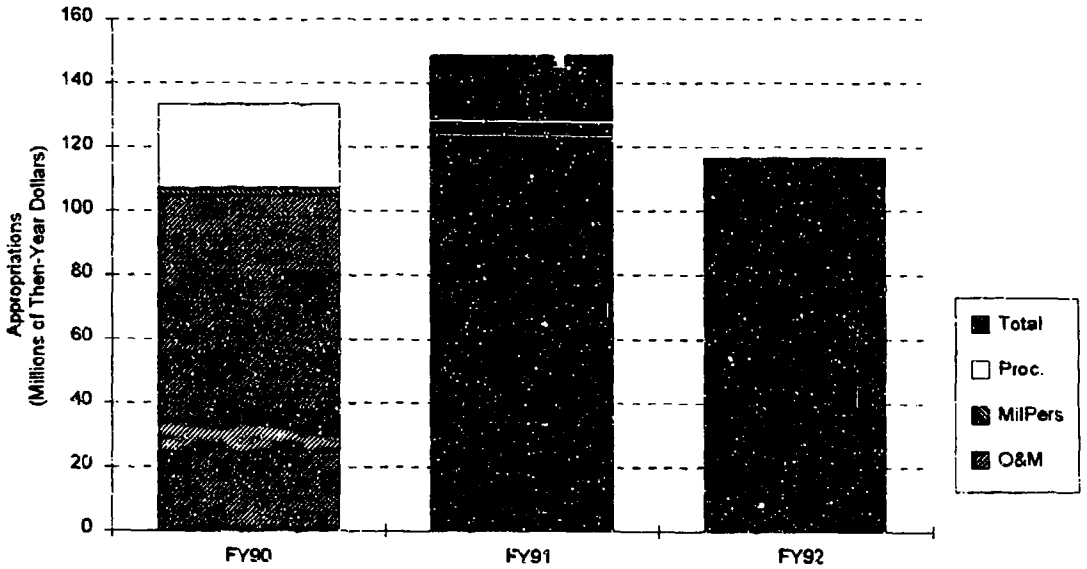
8 Regarding category (1), the Services control minor construction (projects smaller than $300,000). The FYDP showed $30.4 million of minor construction for the Navy in FY90, and $15.4 million for the Army. The Bureau of Medicine and Surgery staff provided a breakout of the $30.4 million, which funded construction of bachelor enlisted quarters and parking structures associated with Navy hospitals. We deemed these expenditures to be unrelated to the peacetime-care mission, and therefore excluded them from the analysis. Although we did not have access to a breakout of the Army's $15.4 million, we excluded those expenditures as well. Thus, minor construction had no effect on our final estimates.

4. Central Automation Support

The Defense Medical Systems Support Center (DMSSC) provides central automation support to the entire DoD medical community, including CHAMPUS as well as military hospitals. An adjustment to MEPRS is required, because the corresponding cost would be passed along to customers in the prices charged by civilian-sector providers. However, we must be careful to pass along only a portion of the DMSSC cost to MEPRS; the remainder is implicitly passed along to CHAMPUS, which is also supported by DMSSC.

Figure III-5 displays the DMSSC appropriations, in detail for FY90 and in total for FY91 and FY92. DMSSC is funded through Program Element 0807791D, and the total appropriation has remained relatively stable over the period FY90 to FY92.



Note: O&M=Operations and Maintenance, MilPers=Military Personnel, and Proc.=Procurement.

Figure III-5. DMSSC Appropriations

We have spread the FY90 DMSSC total appropriation across the three Services in proportion to the sum of each Service's CHAMPUS expenses plus its total MEPRS expenses in accounts A, B, C, and F. This procedure is illustrated in Table III-4. The DoD

total in MEPRS plus CHAMPUS[9] was $10.3 billion in FY90. The $133 million DMSSC total represents 1.29% of the DoD total. Therefore, we imposed a charge of 1.29 cents on each dollar of MEPRS expense, as well as a similar charge on each dollar of CHAMPUS expense. In effect, this procedure allocates $40.9 million to Army MEPRS cost, $32.8 million to Air Force MEPRS cost, and $25.1 to Navy MEPRS cost. The presumption is that the Army, having the largest MEPRS cost, derives the most benefit from DMSSC.

Table III-4. Allocation of FY90 DMSSC Appropriation (Millions of Dollars)

	Army	Air Force	Navy	DoD total
MEPRS Account:				
A (Inpatient)	1,016	763	597	2,377
B (Ambulatory)	1,198	1,077	827	3,102
C (Dental)	292	250	185	727
F (Special Programs)	666	458	338	1,462
MEPRS Total:	3,173	2,548	1,948	7,669
CHAMPUS	904	756	1,001	2,661
Service Total:	4,076	3,304	2,949	10,329
DMSSC Allocation to MEPRS	40.9	32.8	25.1	98.7
DMSSC Allocation to CHAMPUS	11.6	9.7	12.9	34.3
Total DMSSC Allocation:	52.5	42.5	38.0	133.0

5. Military Personnel Pay Factors

MEPRS imputes military-personnel compensation as the product of full-time equivalents (FTEs) recorded at MTFs and a set of annual pay factors. In this subsection, we distinguish between five different pay factors that could potentially be used in this calculation:

- Service-comptroller pay factors,
- MEPRS pay factors,

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9 The source for the CHAMPUS data is "CHAMPUS Chartbook of Statistics," Office of the Civilian Health and Medical Program of the Uniformed Services, Publication 5400.2-CB, October 1992, p. IV-7. We used the government cost, excluding European claims but including both the CHAMPUS Reform Initiative and the CHAMPUS mental health demonstration (Norfolk, Virginia).

- FYDP pay factors,
- OSD (Health Affairs) pay factors, and
- IDA pay factors.

As we described in Chapter II, each Service annually publishes one FYDP pay factor for officers and another for enlisted personnel; each factor is an average over all officer ranks (or enlisted paygrades) as well as all occupational specialties. We also described the modifications that IDA made to the rank- and medical-specific, OSD (Health Affairs) pay factors in arriving at the IDA pay factors. Specifically, the FICA component was included in the IDA pay factors, but the Health-Care Accrual, Accession & Training, and PCS components were deleted.[10] These modifications are summarized in Table III-5.

Table III-5. Comparison of Military Pay Factors

	Service Comptrollers	MEPRS	FYDP	OSD (Health Affairs)	IDA
Pay Component					
Base Pay	Y	Y	Y	Y	Y
Allowances	Y	Y	Y	Y	Y
Retirement Accrual	Y	Y	Y	Y	Y
Incentive and Special Pays	A	A	A	M	M
PCS	Y	Y	N	Y	N
Health-Care Accrual	N	N	N	Y	N
Accession & Training	N	N	N	Y	N
FICA	Y	Y	Y	N	Y
Properties					
Medical-specific	N	N	N	Y	Y
Rank/paygrade-specific	Y	Y	N	Y	Y

Key: Y=included, N=excluded, M=medical-specific special pays, A=average special pays.

The Service-comptroller pay factors, used for inter-agency exchange, are dimensioned by fiscal year, Service, and either officer rank or enlisted paygrade.[11]

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[10] Health-Care Accrual was deleted because it is neither precisely estimated nor generally recognized as a current-year expense. Accession & Training was deleted because many of those expenses are already captured in MEPRS, and there is no reliable method for estimating the amount currently excluded from MEPRS. Finally, PCS was excluded because the larger IDA methodology captures those costs explicitly in the PCS Program Elements (PEs 0808731A/N/M/F for Army, Navy, Marine Corps, Air Force, respectively), rather than burdening them on personnel pay rates.

[11] For example, the FY91 factors for all four Services are contained in "Composite Standard Military Rates, Basic Allowance for Quarters Rates, and Permanent Change of Station Expense Rates, Effective 1 October 1990," Comptroller of the Navy, NavComptNote 7041, October 1990.

Although rank-specific, the Service-comptroller pay factors are averages over all occupational specialties, and are not medical-specific. Finally, the MEPRS pay factors were surprisingly difficult for us to obtain, but are generally presumed to be equal to the Service-comptroller pay factors. We were able to obtain the MEPRS pay factors in one case, the Air Force in FY91. Looking across all the officer ranks and enlisted paygrades, the MEPRS pay factors never differed from the Service-comptroller factors by more than 1.65%.

Table III-6 is an attempt to assess, in the aggregate, the effect on total MEPRS expense of substituting the IDA pay factors for the MEPRS pay factors. We report the averages (across ranks and paygrades) of both the IDA pay factors and the MEPRS pay factors, for the Air Force in FY91. The averages were computed by weighting across rank/paygrade distributions provided by the Defense Manpower Data Center (DMDC).[12] We multiplied the pay differences by the number of FTEs in each category, as reported in MEPRS, to obtain the pay adjustment (in millions of dollars).

Table III-6. Adjustment for MEPRS Military-Personnel Pay Factors, Air Force, FY91

Personnel Category	IDA Pay Factor	MEPRS Pay Factor	IDA Factor Minus MEPRS Factor	Full-Time Equivalents (FTEs)	Pay Adjustment (Millions of FY91 Dollars)
Physicians	$98,813	$80,263	$18,550	2,968	55.1
Nurses	$58,704	$63,409	($4,705)	3,625	(17.1)
Medical Service Corps	$63,029	$66,346	($3,317)	2,381	(7.9)
Medical Enlisted	$27,596	$29,522	($2,016)	17,213	(34.7)
Total Adjustment					(4.6)
MEPRS Subtotal					1,840
Percentage Adjustment					(0.25%)

Although MEPRS understates average physician compensation by nearly $19,000, it *overstates* the compensation of nurses, MSC officers, and medical enlisted personnel.

[12] MEPRS does not break FTEs by rank or paygrade. Instead, we computed the rank/paygrade distributions by combining DMDC personnel-inventory data in the two primary Program Elements that support MTFs: PE 0807711 (Care in Regional Defense Facilities) and PE 0807792 (Station Hospitals and Medical Clinics). We implicitly assume that the rank/paygrade distributions by personnel assignment approximate those of FTEs recorded in MEPRS.

The latter effect occurs because medical enlisted personnel do not receive aircrew pay, submarine-duty pay, hazardous-duty pay, and sea pay to the same extent as other, non-medical personnel. In light of the relatively large number of medical enlisted personnel, the net effect is actually a *downward* adjustment to MEPRS of $4.6 million. However, this adjustment represents a mere 0.25% of the Air Force MEPRS inpatient and ambulatory subtotal. Because this adjustment is so small, and because the exact MEPRS pay factors were not readily available for other combinations of Service branch and fiscal year, we have ignored the adjustment in our subsequent calculations.

While the MEPRS pay factors impart no bias in the aggregate, they do give a misleading picture of the *relative* costs of various categories of personnel. For other purposes, such as determining the optimal mix of physicians, nurses, and medical enlisted personnel, it would be better to use the IDA pay factors developed in Chapter II. Otherwise, the MEPRS pay factors may lead to a mix that is too rich in physicians relative to the other categories of personnel.

6. Allocation of MEPRS Special-Programs Accounts

The MEPRS F (Special Programs) accounts were originally designed to measure costs incurred at MTFs in support of DoD's wartime readiness mission. Over the years, as additional three-digit accounts were added, some costs related instead to the peacetime health-care mission have migrated to the F accounts. The purpose of this section is to fold back to the A (Inpatient) and B (Ambulatory) accounts those specific three-digit F accounts that are demonstrably and exclusively related to the peacetime-care mission.

After consultation with officials in OSD (Health Affairs), we selected certain F accounts that, in our opinion, correspond exclusively to peacetime care. The F accounts that we selected are analyzed in Table III-7. The Area Reference Laboratories provide clinical laboratory and forensic toxicology procedures and tests to other MTFs. Of the ten laboratories, nine are operated by the Army, and the remaining one is operated by the Navy at NNMC Bethesda. However, the Navy did not report any expenses in MEPRS account FAA (Area Reference Laboratories) in either FY90 or FY92. The Army total of $21.2 million supported not just Army MTFs, but actually all MTFs. Therefore, we allocated this sum across the Services in proportion to their total MEPRS inpatient and ambulatory expenses. This allocation amounts to 0.39% of the MEPRS A and B accounts. In absolute terms, the allocations are $8.6 million for the Army, $7.1 million for the Air

Force, and $5.5 million for the Navy. To the extent that the Army laboratories disproportionally support Army MTFs, as is often asserted, these allocations will bias the costs low for the Army and high for the other two Services.

Table III-7. Allocation of MEPRS Special-Programs Accounts, FY90

Account Code	Account Title	Army	Air Force	Navy	DoD Total
FAA	Area Reference Laboratories				21,227,080
	Allocation of FAA, by Service	8,579,128	7,128,386	5,519,567	21,227,080
FAH	Clinical Investigation Program	15,710,656	13,046,012	3,118,337	31,875,005
FAK	Student Expenses	103,386,956	40,321,354	39,395,058	183,103,368
FAL	Continuing Health Education	25,842,780	16,443,939	16,136,399	58,423,118
	Subtotal	153,519,520	76,939,691	64,169,361	294,628,571
FEA	Patient Transportation	37,165,712	7,002,563	11,022,300	55,190,575
FEB	Patient Movement Expenses	848,523	9,611,576	1,683,270	12,143,369
FEC	Transient Patient Care	14,980	11,283	55,119	81,382
	Subtotal (FEA, FEB, FEC)	38,029,215	16,625,422	12,760,689	67,415,326
	Total	191,548,735	93,565,113	76,930,050	362,043,897
A	Total inpatient expenses	1,016,201,564	763,289,016	597,216,755	2,376,707,335
	Allocation excluding FEA and FEB	70,453,035	31,918,880	26,900,111	
	Percentage adjustment	6.93%	4.18%	4.50%	
	Allocation of FEA and FEB	38,029,215	16,625,422	12,760,689	
	Percentage adjustment	3.74%	2.18%	2.14%	
	Total inpatient adjustment	10.68%	6.36%	6.64%	
B	Total ambulatory expenses	1,198,135,627	1,076,600,769	827,424,836	3,102,161,232
	Allocation excluding FEA and FEB	83,066,484	45,020,811	37,269,249	
	Total ambulatory adjustment	6.93%	4.18%	4.50%	

We allocated accounts FAH (Clinical Investigation Program), FAK (Student Expenses), and FAL (Continuing Health Education) directly to each Service. The FAH account records expenses intended to: "advance the quality of healthcare rendered in military medical facilities, as measured by presently accepted professional standards,

including statistical health data [and] accreditation evaluation.[13]" The FAK account reports student salary expenses in the following categories: continuing post-graduate education for physicians, dentists, veterinarians, and nurses; and continuing training for medical specialists, allied health-science personnel, administrators, other enlisted direct-care paraprofessionals, and assigned non-medical personnel.[14] Specifically, the FAK account reports: "student salary expenses [for] time the student is in a pure learner role (classroom, work-center learning, etc.) .... Salary expenses related to that time a student directly contributes to work-center output may be charged to the work center."[15] Physicians charge all of their time to FAK during their first year of post-graduate training, and a nominal 50% of their time during their second and subsequent years of training. Finally, the FAL account records: "operating expenses required to support continuing education ... [including] tuition, TAD [temporary additional duty] and/or TDY [temporary duty] expenses, salaries, fees, and contractual expenses."[16]

We allocated these accounts across each Service's total MEPRS inpatient and ambulatory expenses. For example, of the Army subtotal of $153.5 million in accounts FAA, FAH, FAK, and FAL, we allocated $70.4 million to inpatient expenses and $83.1 million to ambulatory expenses. Thus, we increased the MEPRS A and B accounts by a factor of 6.93% each for the Army. Similarly, we increased these accounts by 4.18% for the Air Force and 4.50% for the Navy.

Expenses in the FAK account are accrued primarily in medical centers and the few community hospitals that offer Graduate Medical Education (GME), although some expenses may be accrued at smaller facilities that train enlisted medical specialists and paraprofessionals. Had we allocated these costs directly (and exclusively) to the medical centers and teaching hospitals, these facilities would have appeared more expensive than the remaining hospitals. We felt it was inappropriate to burden the medical centers and

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13 "Medical Expense and Performance Reporting System for Fixed Military Medical and Dental Treatment Facilities," p. 2F-8.

14 Ibid., pp. 2E-10 to 2E-11. Note that expenses other than student salaries (e.g., instructor salaries, medical library, medical illustration, and medical photography) are reported in MEPRS accounts EBE (Graduate Medical Education Support) and EBF (Education and Training Program Support). These intermediate operating accounts are stepped-down to the final operating accounts (i.e., Inpatient, Ambulatory, or Dental) based on FTEs as recorded in personnel timesheets. Thus, they are already reflected in MEPRS, and need not be treated as additional adjustments.

15 Ibid., p. 2F-9.

16 Ibid., p. 2F-9.

teaching hospitals with the entire FAK total. Instead, GME supports the flow of new physicians to replenish *all* of the hospitals in the system. For this reason, we treated the FAK account as system-wide overhead.

Along these lines, we considered including adjustments for PE 0806721 (Uniformed Services University of the Health Sciences) and PE 0806722 (Armed Forces Scholarship Program). Ultimately, we decided to treat these two activities as "below-the-line," and we did not include them in the MEPRS adjustments. These activities do not represent patient care provided in MTFs; in particular, the Armed Forces Scholarship Program funds medical education provided by civilian institutions. Rather than incorporating these activities into MEPRS, they should be added back to the sum of the IDA and RAND cost estimates for any analytical cases under consideration. An example of this approach is given in Chapter IV. If these activities are expected to change under the analytical cases, then that calculation should be conducted independently of either the IDA or RAND cost analyses.

We also considered MEPRS accounts FEA (Patient Transportation), FEB (Patient Movement Expenses), and FEC (Transient Patient Care). Account FEA covers expenses to: "operate and maintain emergency medical vehicles and ambulances ... for the movement of non-emergency inpatients and out-patients to, from, and between MTFs ... [and for] patients who require immediate care on an unscheduled basis enroute to an MTF." Account FEB records expenses to: "move inpatients, out-patients, and attendants between medical facilities to provide optimum care." Account FEC covers expenses to: "provide care to transient patients [at] facilities located on air routes used by the aeromedical evacuation system."[17] These three accounts pertain to transportation assets, such as buses and ambulances, that are owned by the medical community, *not* airlift assets owned by operational units in Major Force Program 2 (General Purpose Forces). Although the MEPRS manual mentions out-patients as well as inpatients, our experience reveals that most of these expenses are related to inpatients. Therefore, we have allocated accounts FEA, FEB, and FEC to the MEPRS A account only. This allocation amounts to 3.74% for the Army, 2.18% for the Air Force, and 2.14% for the Navy.

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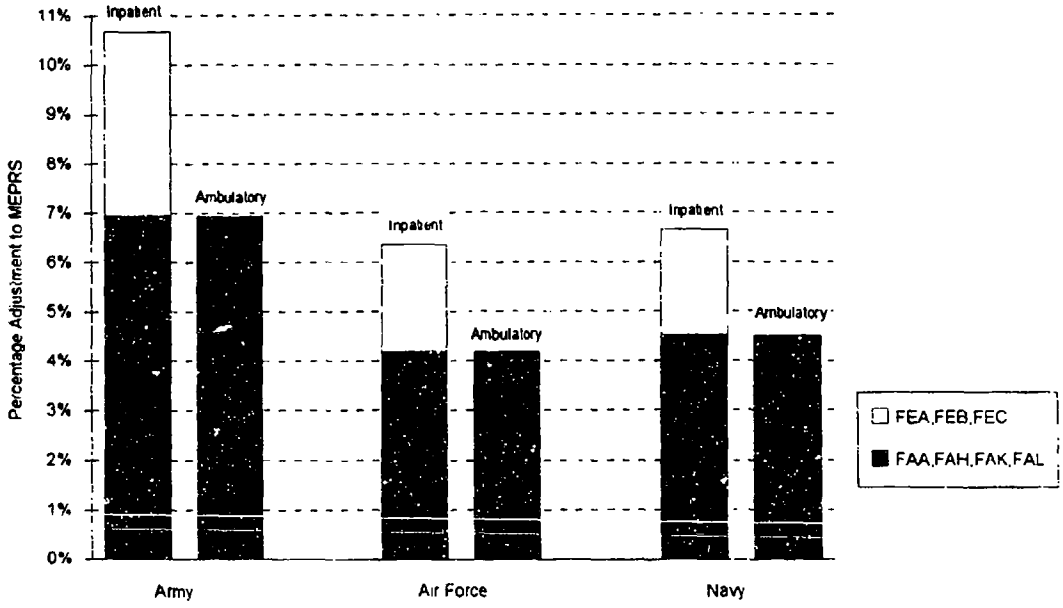
17 "Medical Expense and Performance Reporting System for Fixed Military Medical and Dental Treatment Facilities," p. 2F-20.

The total F account adjustments are illustrated in Figure III-6. The total inpatient adjustments are 10.68% for the Army, 6.36% for the Air Force, and 6.64% for the Navy. The adjustment is largest for the Army, primarily because they operate the largest GME program, as reflected by the total of $103 million in their FAK (Student Expenses) account in FY90.

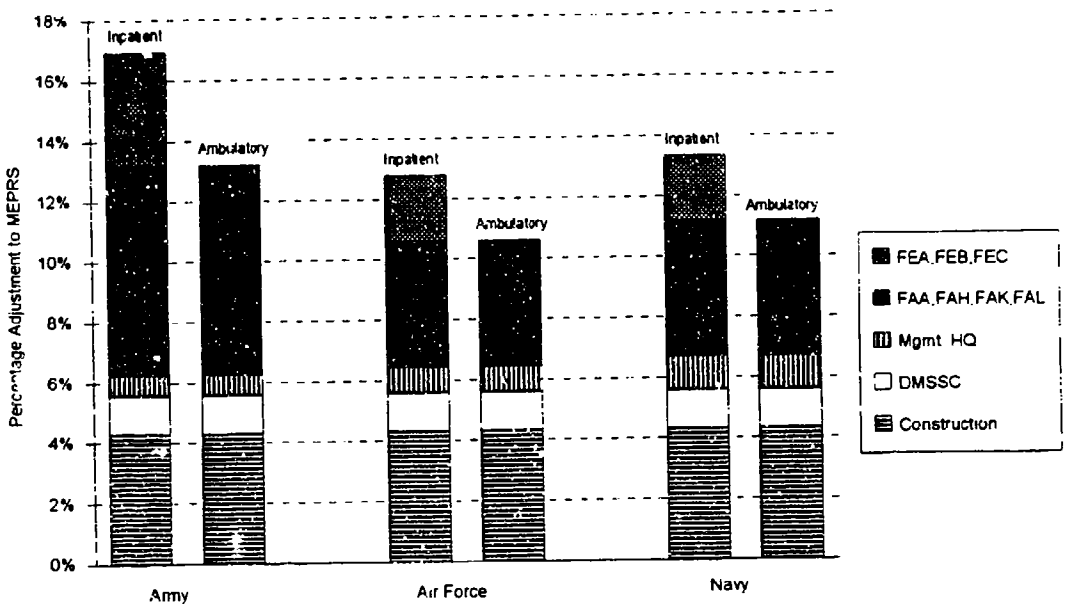


Notes: FAA=Area Reference Laboratories, FAH=Clinical Investigation Program, FAK=Student Expenses, FAL=Continuing Health Education, FEA=Patient Transportation, FEB=Patient Movement Expenses, and FEC=Transient Patient Care.

Figure III-6. Percentage Adjustments Based on MEPRS F Accounts

7. Summary

Figure III-7 summarizes our adjustments to the FY90 MEPRS expenses. Recall that our analyses of base operations and military-personnel pay factors did not lead to any net adjustments. We developed a 4.3% facilities-construction allowance, based upon amortizing construction costs over a 40-year lifetime at a 3.8% real interest rate. Our factor of 1.29% for DMSSC was derived by spreading the DMSSC appropriation across the three Services, in proportion to their total MEPRS expenses. The adjustment for management headquarters was based on an expenditure of $21.7 million per Service. Finally, the adjustments based on MEPRS F accounts were given in Figure III-6, with larger adjustments for inpatient care to reflect patient transportation and movement expenses.



Notes: FAA=Area Reference Laboratories, FAH=Clinical Investigation Program, FAK=Student Expenses, FAL=Continuing Health Education, FEA=Patient Transportation, FEB=Patient Movement Expenses, FEC=Transient Patient Care, and DMSSC=Defense Medical Systems Support Center.

Figure III-7. Summary of Adjustments to FY90 MEPRS Expenses

The total adjustments are approximately equal for the Air Force and the Navy: 12.8% for Air Force inpatient expenses, 13.3% for Navy inpatient expenses, 10.6% for Air Force ambulatory expenses, and 11.2% for Navy ambulatory expenses. The adjustments are larger for the Army: 16.9% for inpatient expenses, and 13.2% for ambulatory expenses. The larger Army adjustments result from larger totals in the F accounts; as shown previously in Table III-7, the Army subtotal in accounts FAA, FAH, FAK, FAL, FEA, FEB, and FEC is twice as large as either the Air Force or the Navy subtotal. By far the largest factor in this difference is the FAK (Student Expenses) account, reflecting the fact that the Army operates the largest GME program among the Services.

C. ASSESSMENT OF ADJUSTED MEPRS EXPENSES

The MEPRS adjustments may be assessed by examining their impact on aggregate MEPRS expenses. Table III-8 shows the reported FY92 MEPRS expenses, by inpatient versus ambulatory care, Service branch, and hospital size. Reported inpatient expenses were $2.41 billion for inpatient care, and $3.20 billion for ambulatory care. The corresponding adjusted figures are $2.76 billion for inpatient care, and $3.56 billion for

ambulatory care. The aggregate percentage adjustments are 14.3% and 11.3%, respectively. Having made these adjustments, we are much more confident about making a fair comparison to medical costs in the civilian sector.

Table III-8. Comparison of Reported and Adjusted FY92 MEPRS Expenses (Millions of FY92 Dollars)

		MEPRS FY92 Reported	MEPRS FY92 Adjusted
Inpatient			
Army	Medical Center	688.4	799.9
	Hospital	393.7	457.5
Air Force	Medical Center	383.7	432.5
	Hospital	335.7	378.3
Navy	Medical Center	373.4	420.8
	Hospital	236.8	266.9
Inpatient Total		2,411.7	2,755.9
Ambulatory			
Army	Medical Center	527.9	593.9
	Hospital	696.6	783.7
	Clinic	19.0	21.4
Air Force	Medical Center	295.8	326.9
	Hospital	658.9	728.1
	Clinic	98.1	108.3
Navy	Medical Center	362.4	400.8
	Hospital	457.7	506.2
	Clinic	81.7	90.4
Ambulatory Total		3,198.1	3,559.6
Total Cost		5,609.8	6,315.5

D. ADDITIONAL DATA ELEMENTS

A few of the data elements required for the regression analysis were derived from sources other than MEPRS. These data elements and their sources are described here.

1. Bed Capacity

The two candidate measures of bed capacity for inpatient care are normal beds and operating beds. Both measures are reported by the Services to DMFO. Normal bed capacity is defined as:

> Space for patients' beds measured in terms of beds, which can be set up in wards or rooms designated for patients' beds and spaced approximately 100 to 120 square feet per bed. *This definition refers only to space and excludes equipment and staff capability.* For containment-type hospitals still in use, bed capacity may be measured in beds spaced on 8-foot centers. Former ward or room space, which has been disposed of or has been altered so that it cannot be readily reconverted to ward or room space, is not included in computing bed capacities. Space for beds used only in connection with examination or brief treatment periods, such as that in examining rooms or in the physiotherapy department, is not included in this figure. Nursery space is not included in the bed capacity, but is accounted for separately in terms of the number of bassinets it accommodates. [Emphasis added.][18]

By contrast, an operating bed is defined as: "a bed that is currently set up and ready in all respects for the care of a patient. *It must include supporting space, equipment, and staff to operate under normal conditions.* Excluded are transient patients' beds, incubators, bassinets, labor beds, and recovery beds."[19] [Emphasis added.] Because operating beds are fully staffed, they appear to be the more appropriate capacity measure for hospitals in peacetime. Indeed, preliminary regression models using normal beds did not predict MTF costs as accurately as the later models using operating beds.

The data on normal and operating beds have not always been regularly updated. In our judgment, the FY90 data had not been updated recently enough to be of use in this study. The FY92 data, however, appear to be both more recent and more relevant. Therefore, we applied the FY92 numbers of normal and operating beds in our analyses of both FY90 and FY92 data on cost and workload.

The relationship between normal and operating beds is illustrated in Figure III-8. The jagged curve represents the trend in daily census at Naval Hospital San Diego during FY90. For reference, we note that the average daily census equals 392, and the 80th

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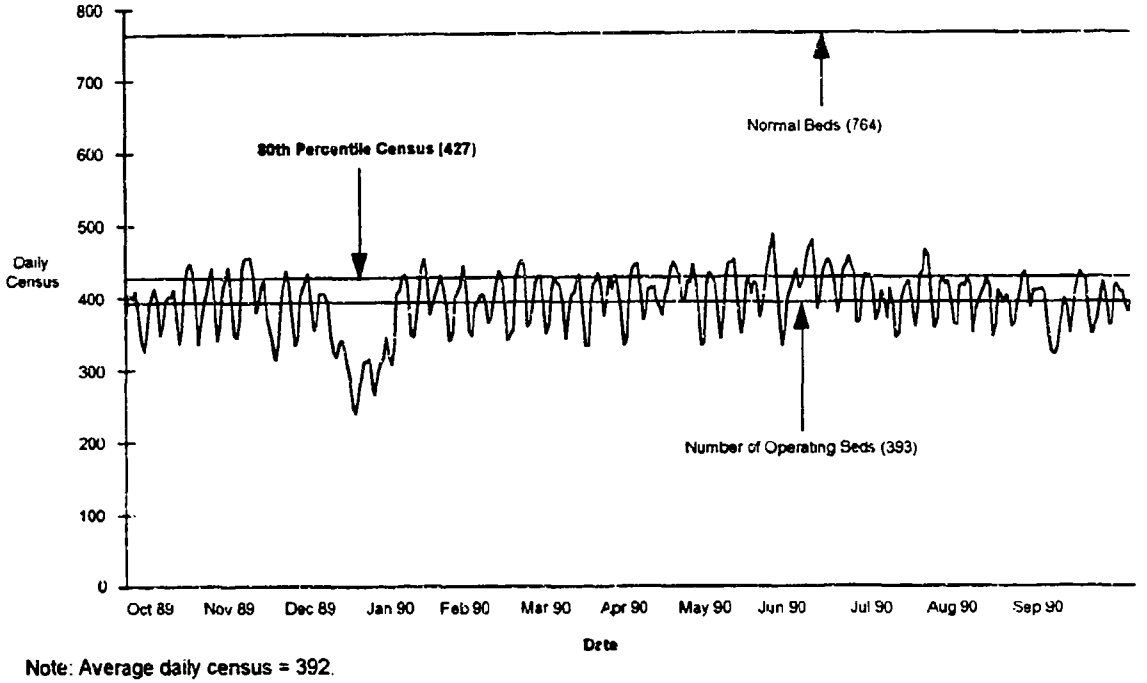
[18] "Medical Expense and Performance Reporting System for Fixed Military Medical and Dental Treatment Facilities," p. A-18.

[19] Ibid., p. A-19.

percentile of the daily census equals 427. Operating beds were reported as 393. This figure certainly lies within the range observed for the daily census. If operating beds represent staffed capacity, however, one might expect this value to exceed the mean and possibly exceed the 80th percentile as well. We suspect that operating beds are not updated frequently enough to reflect seasonal changes in staffing that occur within the fiscal year.



Note: Average daily census = 392.

Figure III-8. Naval Hospital San Diego, FY90 Daily Census

By contrast, normal beds were reported as 764. This figure bears no apparent relationship to the trend in daily census, and offers little indication of peacetime capacity. Similar patterns were observed at several other MTFs that we examined. We conclude that reported operating beds in FY92, though imperfect, provide the best available proxy for peacetime capacity.

2. Graduate Medical Education

We measured the volume of GME by the begin-year headcount of residents and interns at each MTF. This information was provided by OSD (Health Affairs/Professional Affairs and Quality Assurance). This measure differs from the one used by the Health Care

Financing Administration (HCFA) for Medicare reimbursement.[20] The HCFA measure is defined as the headcount of resident and interns, divided by the number of staffed beds at each hospital; the HCFA definition of staffed beds is roughly analogous to the DoD definition of operating beds. The HCFA measure is relevant for inpatient care only, with staffed beds serving as a capacity variable. There is no obvious capacity variable for ambulatory care. In our data on MTFs, we found evidence that GME affects the cost of ambulatory care as well as inpatient care. The advantage of our GME measure (i.e., the simple headcount) is that it does not require a capacity variable; thus, it is well-defined even on the ambulatory side. The GME data are reproduced in Table III-9.

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[20] Health Care Financing Administration, "Federal Register," Vol. 52, No. 169, September 1, 1987.

Table III-9. Size of Graduate Medical Education Programs, FY90 and FY92

DMIS ID Code	Facility Name	Facility Type	Number of Residents Plus Interns		Percentage Change. FY90 to FY92
			FY90	FY92	
0014	David Grant USAF Medical Center	Medical Center	104	103	(1.0)%
0022	Letterman AMC	Medical Center	20	0	(100.0)%
0027	NH Oakland	Medical Center	147	72	(51.0)%
0029	NH San Diego	Medical Center	339	298	(12.1)%
0031	Fitzsimons AMC	Medical Center	197	197	0.0%
0037	Walter Reed AMC	Medical Center	524	427	(18.5)%
0047	Eisenhower AMC	Medical Center	120	120	0.0%
0052	Tripler AMC	Medical Center	198	198	0.0%
0055	USAF Medical Center, Scott AFB	Medical Center	25	25	0.0%
0066	Malcolm Grow USAF Medical Center	Medical Center	37	37	0.0%
0067	NNMC Bethesda	Medical Center	256	217	(15.2)%
0073	Keesler Medical Center	Medical Center	88	88	0.0%
0095	USAF Medical Center, Wright-Patterson AFB	Medical Center	109	109	0.0%
0108	William Beaumont AMC	Medical Center	137	127	(7.3)%
0109	Brooke AMC	Medical Center	273	273	0.0%
0117	Wilford Hall USAF Medical Center	Medical Center	375	395	5.3%
0124	NH Portsmouth	Medical Center	196	190	(3.1)%
0125	Madigan AMC	Medical Center	201	194	(3.5)%
0023	Hays AH	Community Hospital	19	19	0.0%
0024	NH Camp Pendleton	Community Hospital	37	30	(18.9)%
0038	NH Pensacola	Community Hospital	40	35	(12.5)%
0039	NH Jacksonville	Community Hospital	39	34	(12.8)%
0042	USAF Regional Hospital Eglin	Community Hospital	17	17	0.0%
0048	Martin AH	Community Hospital	36	36	0.0%
0078	Ehrling Berquist Regional Hospital	Community Hospital	6	6	0.0%
0089	Womack AMC	Community Hospital	35	35	0.0%
0 03	NH Charleston	Community Hospital	37	27	(27.0)%
0110	Darnall AH	Community Hospital	25	25	0.0%
0116	Robert Thompson Strategic Hospital	Community Hospital	23	23	0.0%
0123	Dewitt AH	Community Hospital	18	18	0.0%
0126	NH Bremerton	Community Hospital	14	6	(57.1)%
	Total		3,693	3,381	(8.4)%

IV. PEACETIME COST OF THE WARTIME MEDICAL REQUIREMENT

This chapter estimates the cost of maintaining *during peacetime* the resources required for wartime medical care. This estimate is not directly used in the analysis of peacetime medical options considered in Chapters V and VI. However, it does set a floor on the size (in dollars) of the peacetime medical establishment, as well as answer a question posed in the congressional language that prompted this study.

Wartime medical resources consist of two major components. The *casualty-based* component is determined by wartime casualty and disease/non-battle injury (DNBI) rates, and corresponds to echelons 3 and 4 of wartime medical care.[1] The number of casualties and DNBI were computed by the OD(PA&E) Wartime Medical Requirements Working Group, based upon simulations conducted by the Joint Staff. The *structure-based* component contains medical personnel organic to combat and combat-support units (e.g., the medical platoon of an infantry battalion). This component corresponds to echelons 1 and 2 of wartime medical care, and is essentially independent of expected casualty levels. In fact, we include as wartime capability those medical personnel assigned to *all* combat and combat-support units extant in peacetime, regardless of which units would actually deploy during any particular wartime contingency.

We first estimate the peacetime cost of the casualty-based medical resources. We estimate this cost under alternative assumptions concerning the mix of active-duty and reserve medical personnel in the theater. Next, we estimate the peacetime cost of the wartime medical structure. This estimate is obtained by selecting a subset of the fully and partially medical program elements already identified in Chapter II. The current chapter describes both the logic for selecting this subset, as well as the resulting cost estimate.

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[1] Echelon 1 provides essential emergency care to prepare casualties for evacuation to the rear. Echelon 2 provides assembly points where emergency care is provided and the priority for continued evacuation to the rear is determined. Echelon 3 consists of limited medical facilities, such as Mobile Army Support Hospitals (MASHs) and Combat Support Hospitals (CSHs), that provide resuscitation, initial surgical procedures, and post-operative treatment as necessary. Echelon 4 consists of hospitals in the Communications Zone that provide definitive care and recuperation prior to return to duty or evacuation to the continental United States (CONUS).

Finally, we combine the casualty-based and structure-based costs to yield an estimate of the total peacetime cost of the wartime medical requirement.

A. PEACETIME COST OF THE CASUALTY-BASED MEDICAL REQUIREMENT

1. Methodology

Physicians who are required for the wartime mission must maintain their medical proficiency in peacetime. Their peacetime activities contribute to this objective. Therefore, we have treated essentially all of the costs associated with their *peacetime* activities as related to the *wartime* mission.

We considered alternative treatments of peacetime cost before deciding on this approach. It could be argued that only a portion of a physician's peacetime activity is necessary as continuing training. Estimating the size of this portion, however, would be far from straightforward. It might even be argued that military physicians could work outside of military hospitals to maintain their proficiency in peacetime, freeing DoD from paying any costs associated with their peacetime activity. Ultimately, we formulated our chosen approach for fidelity with one of the goals of the Section 733 Study: estimating how much DoD *does* pay to be medically prepared for wartime, not how little it *might* pay if it managed its physicians differently.

We assumed that the physicians required for wartime casualty care are occupied in peacetime by practicing medicine in CONUS MTFs and clinics. We then used data from the Medical Expense and Performance Reporting System (MEPRS) to estimate the full peacetime costs associated with a single physician full-time equivalent (FTE) in that environment. In "full peacetime costs," we included not only the physician's salary and bonuses, but also the salary costs of other personnel who support the physician FTE (e.g., FTEs of nurses, medical technicians, hospital administrators, and so on), as well as the materials, supplies, and other non-labor costs associated with the physician FTE. This treatment is conservative (i.e., tends to overstate peacetime costs) to the extent that some physicians engage in peacetime activities that are considerably less costly than practicing medicine in CONUS MTFs. Among these alternative activities are serving as instructors, serving on headquarters staffs, and practicing medicine under more austere conditions (such as aboard ship or in overseas troop clinics). The peacetime costs of these alternative activities might be better approximated by the physician's salary and bonuses alone, without the extra burdening for indirect costs from MEPRS. We chose our

approach not only because it is conservative (and thus the direction of the bias is unambiguous), but also because the wartime casualty-care requirements (for both care in theater and care of CONUS evacuees) *could* be satisfied by simply drawing physicians out of CONUS MTFs.

We drew a distinction between "direct" physicians and "indirect" physicians. A direct physician is one whose specialty directly maps into a clinical area in the MEPRS chart of accounts. By contrast, indirect physicians, including anesthesiologists, pathologists, and radiologists, have their peacetime costs spread through a pool over a number of clinical areas. Further, we defined a "physician team" as a direct physician, plus the complement of personnel who support the physician in CONUS MTFs during peacetime. The physician team includes a fractional allocation of indirect physicians, as well as the non-physician personnel (e.g., nurses, medical technicians, hospital administrators) previously mentioned. Finally, the cost of a physician team also includes the non-labor costs expended by the direct physician and his or her supporting personnel in peacetime. Note that physician teams are nowhere recognized in the official DoD data systems; rather, they are an analytical device developed for the purposes of this study.

One advantage to using the physician team as the basic unit of analysis is that the wartime requirements estimated by the Joint Staff are stated in terms of beds and physicians,[2] but there is no direct statement of the requirements for non-physician personnel. The physician team concept serves to associate non-physician personnel with each physician, thereby rounding-out the overall requirement for medical personnel. The alternative approach would have been to augment the wartime requirements for physicians with computed wartime requirements for non-physicians. The data required for the latter approach were not available to the Section 733 Study.

One qualification regarding our approach is in order. We implicitly assumed that the ratio of non-physicians to physicians is at least as high in peacetime as in wartime. For example, suppose that one physician is supported by two nurses in wartime, but by three nurses in peacetime (so the peacetime physician team contains three nurses). Then the cost of the peacetime physician team includes the cost of the three nurses required for peacetime support; it also implicitly covers the cost of the two nurses required for

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2 Physician requirements are stated in total as well as in five broad, all-inclusive specialties: anesthesiologist, orthopedic surgeon, general surgeon, other surgeon, and other physician. A finer specialty breakdown can be obtained by applying Service-specific hospital staff factors to the physician totals. This procedure is illustrated in a later section.

wartime. Now suppose instead that the wartime requirement is increased to four nurses, while the peacetime requirement remains at three nurses. The cost of the peacetime physician team still includes the cost of the three nurses required for peacetime support. However, these three nurses are no longer sufficient to provide wartime care, and the one missing nurse is omitted from the peacetime cost of the wartime requirement. Unfortunately, there was no way to confirm our assumptions because, again, the stated wartime requirements include only physicians, not nurses or any other category of personnel.

2. Data Requirements

The cost of wartime medical care depends on the numbers of casualties and DNBI to be treated, the resulting number of physicians by specialty, and the cost per physician team. The numbers of casualties and DNBI were estimated from the simulations conducted by the Joint Staff. The Wartime Medical Requirements Working Group, in turn, translated casualties and DNBI into requirements for beds and physicians.

The important data elements pertaining to physician teams include full-time equivalent workloads, the salaries of direct physicians, indirect physicians, and other personnel; and the non-labor costs such as materials and supplies. All of these components of physician-team cost come from the MEPRS database, described more fully in the next subsection. The cost of a physician team is:

$$\text{Physician Team Cost} = \frac{\text{Total MEPRS Cost}}{\text{Direct Physician FTEs}}.$$

The physician staff requirements come from the Services, and the bed counts from the Joint Staff. All cost data are for FY90, while the bed counts and resulting physician requirements are based on the FY 1993 scenarios run by the Joint Staff.

a. Physician Team Data

MEPRS cost and FTE data are categorized into inpatient and ambulatory clinical areas as well as other areas that were not used in this analysis.[3] We dropped some clinical areas and combined the remaining inpatient and ambulatory categories into the clinical

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[3] "Medical Expense and Performance Reporting System for Fixed Military Medical and Dental Treatment Facilities." Office of the Assistant Secretary of Defense (Health Affairs), Publication DoD 6010.13M. January 1991.

areas used in the wartime hospitals. The resulting clinical areas used in wartime and their MEPRS counterparts are listed in Table IV-1.

Table IV-1. MEPRS Clinical Areas Corresponding to Wartime Medical Specialties

Wartime Direct-Physician Specialty	MEPRS Code	MEPRS Work Center
Internal Medicine		
	AAA	Internal Medicine
	AGA	Family Practice Medicine
	BAA	Internal Medicine Clinic
	BAQ	Infectious Disease Clinic
Dermatology		
	AAD	Dermatology
	BAP	Dermatology Clinic
Neurology		
	AAJ	Neurology
	BAK	Neurology Clinic
General Surgery		
	ABA	General Surgery
	AGB	Family Practice Surgery
	BBA	General Surgery Clinic
Cardio/Thoracic Surgery		
	ABB	Cardiovascular Thoracic Surgery
	BBB	Cardiovascular and Thoracic Surgery Clinic
Neurosurgery		
	ABD	Neurosurgery
	BBC	Neurosurgery Clinic
Ophthalmology		
	ABE	Ophthalmology
	BBD	Ophthalmology Clinic
Oral Surgery		
	ABF	Oral Surgery
Otorhinolaryngology		
	ABG	Otolaryngology
	BBF	Otolaryngology Clinic
Plastic Surgery		
	ABI	Plastic Surgery
Orthopedics		
	AEA	Orthopedics
	AGG	Family Practice Orthopedics
	BEA	Orthopedics Clinic
	BEB	Cast Clinic
	BEC	Hand Surgery Clinic
	BED	Neuromuscularskeletal Screening Clinic
	BEE	Orthopedic Appliance Clinic
Psychiatric Care		
	AFA	Psychiatrics
	AFB	Substance Abuse Rehabilitation
	AGF	Family Practice Psychiatry

The MEPRS cost data come from both MTFs and stand-alone clinics in CONUS. The cost data were adjusted using the factors developed in Chapter III and summarized in Figure III-7. These adjustments account for military construction, management headquarters, central automation support, and allocation of the MEPRS Special Programs subaccounts. The adjusted MEPRS data, by clinical area, are shown in Table IV-2.

Table IV-2. MEPRS Costs by Clinical Area, CONUS Only (FY90 Dollars)

Clinical Area	Army	Navy	Air Force
Internal Medicine	206,631,245	127,689,566	171,440,728
Dermatology	19,698,899	12,084,532	9,273,269
Neurology	21,040,901	9,371,191	7,748,780
General Surgery	136,362,647	96,959,393	128,020,535
Cardio/Thoracic Surgery	35,298,954	11,114,496	11,927,010
Neurosurgery	29,642,345	13,185,176	9,096,660
Ophthalmology	30,368,605	20,483,424	15,124,085
Oral Surgery	13,805,905	8,029,715	12,699,714
Otorhinolaryngology	38,937,875	38,914,317	24,782,785
Plastic Surgery	12,115,724	6,978,859	5,920,939
Urology	48,978,464	33,246,090	27,570,658
Nephrology	11,917,558	3,425,226	4,101,969
Gynecology	190,467,359	129,708,772	214,621,320
Orthopedics	168,088,285	108,740,355	76,040,209
Psychiatric Care	49,732,083	50,546,922	34,755,919
Total Cost	1,013,086,847	670,478,036	753,124,580

The other data component from MEPRS is the number of full-time equivalent direct physicians (Table IV-3). FTEs measure the hours a direct physician spends in a particular clinical area, and are expressed in annual equivalents. A single physician's time may be divided among several clinical areas, and may also be charged to other areas not shown here, such as readiness training or continuing health education. In addition, some physicians, such as those deployed aboard aircraft carriers in peacetime, do not charge to MEPRS at all. For these reasons, the MEPRS FTE totals do not reach the active-duty inventory totals.

Table IV-3. Direct Physician FTEs by Clinical Area, CONUS Only (FY90, 1 FTE = 1 Year of Effort)

Clinical Area	Army	Navy	Air Force
Internal Medicine	296.5	174.7	248.8
Dermatology	71.6	34.9	23.4
Neurology	64.4	25.5	16.7
General Surgery	160.4	153.1	185.2
Cardio/Thoracic Surgery	30.3	13.1	12.6
Neurosurgery	41.5	19.2	10.8
Ophthalmology	77.1	47.4	30.4
Oral Surgery	19.5	10.8	9.2
Otorhinolaryngology	54.0	78.8	28.3
Plastic Surgery	17.0	9.7	6.9
Urology	55.5	52.2	33.4
Nephrology	18.6	8.9	3.5
Gynecology	239.3	180.6	212.1
Orthopedics	167.7	141.6	88.4
Psychiatric Care	45.3	44.0	19.3
Total Direct-Physician FTEs	1,368.6	994.7	928.8

b. Service Hospital Staff Data

The staff data for notional wartime hospitals were obtained from the Services, and were mapped into MEPRS categories as shown in Table IV-4. Table IV-5 shows the mobile Army specialist teams that are moved around the theater as needed. The staffs for CONUS hospitals were based on the total physicians per hospital cited in the report of the Wartime Medical Requirements Working Group.[4] These total numbers were then spread over the wartime clinical areas based on the staff mix found in the echelon 4 service-specific 500-bed hospital (Table IV-6). For the Army, the field hospital staff was

c. Wartime Bed Counts and Hospital Requirements

The requirement for physician teams is based on the casualty and DNBI flows predicted by the Medical Planning Model (MPM) of the Joint Operational Planning and Execution System (JOPES). The output of the MPM is based on expectations concerning the course of combat in circumstances specified in the Defense Planning Guidance. The scenario-specific results draw on explicit assumptions about the forces involved, the

4 "Wartime Medical Requirements Study in Response to Section 733, National Defense Authorization Act for Fiscal Year 1992, 1993 (U)," Department of Defense, Office of the Director (Program Analysis and Evaluation), Secret, January 1994.

Table IV-4. Service Staff Mix for Wartime Hospitals

	Army				Navy				Air Force		
	Echelon 3		Echelon 4		Echelon 3		Echelon 4		Echelon 3		Echelon 4
	MASH[a] (30 Beds)	CSH[b] (300 Beds)	Field (500 Beds)	General (500 Beds)	CmbtZ[c] (250 Beds)	CmbtZ (500 Beds)	CommZ[d] (500 Beds)	Hospital Ship (1000 Beds	ATH[e] (50 Beds)	CmbtZ (250 Beds)	CommZ (500 Beds)
Direct Physicians											
Internal Medicine	4	12	11	16	19	28	28	20	5	13	10
Dermatology			1			2	2	2		1	1
Neurology				1	1	1	1				
General Surgery	5	7	2	7	7	7	7	28	3	16	21
Cardio/Thoracic Surgery		1		1	1	1	1	2			3
Neurosurgery					1	2	2	4			
Ophthalmology					2	2	2	4		1	2
Oral Surgery		1	1	1		2	4	6		1	2
Otorhinolaryngology		1		1	1	2	2	2		1	
Plastic Surgery								2			
Urology		1		1	1	2	2	2		3	2
Neurology											
Gynecology		1	1	1	1	2	2	2		2	2
Orthopedics	1	5	1	5	6	8	8	16	1	5	4
Psychiatric Care		1	1	1	2	2	2	4		2	
Total Direct Physicians	10	30	18	35	42	61	63	94	9	45	47
Indirect Physicians											
Pathology						1	1	2		1	2
Radiology		2			2	3	3	4		1	2
Anesthesiology	1	3	1	3	6	8	10	24		4	5

[a] Mobile Army Support Hospital.
[b] Combat Support Hospital.
[c] Combat Zone Hospital.
[d] Communications Zone Hospital.
[e] Air Transportable Hospital.

Table IV-5. Army Staff Mix for Mobile Medical Teams

	Surgical	Head and Neck	Neuro-Surgery	Ophthalmology	Pathology	Infectious Disease	Hemo/ Dialysis
Direct Physicians							
Internal Medicine							1
Neurology			1				
Infectious Disease						1	
General Surgery	1						
Neurosurgery			2				
Ophthalmology				3			
Oral Surgery		1					
Otorhinolaryngology		1					
Plastic Surgery		1					
Orthopedics	1						
Nephrology							1
Total Direct Physicians	2	3	3	3	0	1	2
Indirect Physicians							
Pathology					1		

Table IV-6. Staff Mix for CONUS 500-Bed Hospitals

	Army	Navy	Air Force
Direct Physicians			
Internal Medicine	16	9	9
Dermatology		1	1
Neurology	1	1	
General Surgery	17	13	30
Cardio/Thoracic Surgery	2	3	4
Neurosurgery		3	
Ophthalmology		3	3
Oral Surgery	2	7	3
Otorhinolaryngology	2	3	
Plastic Surgery			
Urology	2	3	3
Nephrology			
Gynecology	2	3	3
Orthopedics	12	14	8
Psychiatric Care	1	1	
Total Direct Physicians	57	64	64
Indirect Physicians			
Pathology		1	1
Radiology		1	1
Anesthesiology	7	4	4

duration of the conflict, the intensity of the conflict, casualty and DNBI rates, death rates, the duration of hospital stays, and evacuation policy. A dispersion factor is built into the MPM to provide extra capacity, reflecting potential geographical mismatch between medical resources and the demand for medical care. Evacuation policy deals with the length of time a patient's recovery must be expected to exceed in order to be eligible for evacuation to a higher echelon. Thus, evacuation policy addresses movements between echelons 3 and 4, between echelon 4 and CONUS, and movement directly from echelon 3 to CONUS.

The precise wartime requirements for beds are shown in the previously cited report of the Wartime Medical Requirements Working Group.[5] The bed requirements and the resulting requirements for hospitals and physicians (by specialty) are shown in a classified IDA publication.

3. Cost Estimates

The peacetime cost of wartime medical care varies with the percentage of reservists called to active duty. Because reservists normally work only two weeks per year plus drill periods, their peacetime cost to the Services is much less than the cost of active-duty personnel. This section shows the physician team cost by active duty, reserve duty, and the active/reserve mix developed by the Wartime Requirements Working Group.

a. Total Active-Duty Physician Team Cost

The cost of an active-duty physician team is given by:

$$\text{Physician Team Cost} = \frac{\text{Total MEPRS Cost by Clinical Area}}{\text{Direct Physician FTEs}}.$$

This figure includes the salary cost of direct physicians, indirect physicians, and other personnel, as well as materials and supplies. Recall also that the MEPRS costs were adjusted upwards to reflect military construction, management headquarters, central automation support, and allocation of the MEPRS Special Programs subaccounts. The

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[5] Kathryn L. Wilson, Matthew S. Goldberg, and Bernard J. McHugh, "The Peacetime Cost of Wartime Medical Resources (U)," Institute for Defense Analyses, Paper P-2965, Secret, September 1994.

FTEs in the denominator are the number of annual equivalents worked by the direct physician. The active-duty physician team costs are shown in Table IV-7.

Table IV-7. Total Annual Costs per Active-Duty Physician Team (FY90 Dollars)

Clinical Area	Army	Navy	Air Force
Internal Medicine	696,848	730,929	689,135
Dermatology	275,127	346,560	395,491
Neurology	326,735	366,874	464,254
General Surgery	850,035	633,318	691,405
Cardio/Thoracic Surgery	1,165,046	845,262	949,099
Neurosurgery	713,972	685,241	842,738
Ophthalmology	393,950	432,467	498,172
Oral Surgery	709,147	741,033	1,382,031
Otorhinolaryngology	721,127	493,529	876,491
Plastic Surgery	713,424	720,584	855,936
Urology	747,982	637,112	826,314
Nephrology	639,240	382,742	1,156,299
Gynecology	796,071	718,343	1,011,903
Orthopedics	1,002,609	767,927	860,654
Psychiatric Care	1,097,253	1,148,098	1,801,214

b. Total Reserve Physician Team Cost

Selected Reserves are made up of three general types of reserve duty: Troop Program Unit (TPU), Individual Mobilization Augmentee (IMA) with drilling periods, and IMA with no drilling periods. To estimate the cost of reserve physician teams, we had to consider the type of reserve duty, the number of hours worked in a hospital or clinic setting, and the number of conference days allowed for continuing health education. The breakout by type of reserve duty is shown in Table IV-8.

Table IV-8. Selected Reserve Physicians by Reserve Duty Type (Based on 1993 Inventory)

Type of Reserve Duty	Army	Navy	Air Force
Troop Program Unit	92%	100%	82%
Individual Mobilization Augmentee, drilling	0%	0%	18%
Individual Mobilization Augmentee, no drilling	8%	0%	0%

Source: OSD Reserve Affairs.

Unfortunately, MEPRS does not identify medical personnel by component. For this analysis, we treated reserve physician team pay as a pro-ration of the active physician team pay. Although this apportionment is not quite accurate, offsetting errors may roughly cancel out the inaccuracies. On the one hand, reserve physicians earn lower retirement benefits than do active-duty physicians, so a pro-ration tends to overstate the cost of reserve physician teams. On the other hand, reserve physicians are generally of higher rank than active-duty physicians (typically O-5s versus O-4s). Finally, we made the implicit assumption that reservists split their time between hospitals and clinics in the same proportions as do active-duty personnel. Under these assumptions, the reserve physician team cost is given by:

Reserve Physician Team Cost = (Daily Active Physician Team Cost × Number of Active Medical Days) + (Conference Pay).

The number of active-duty medical days depends not only on the type of reserve duty, but also on the number of days allotted to the annual active tour. Table IV-9 states our assumptions on this issue In addition, each physician is allotted ten days to attend conferences at a daily base-pay rate for an O-5, the median grade among reserve physicians. The total annual conference costs (FY90 dollars) per reserve physician team are as follows:

- Army—$1,389
- Navy—$1,770
- Air Force—$1,772

Table IV-9. Total Annual Active-Duty Days per Reserve Physician Team

Type of Reserve Duty	Number of Days
Troop Program Unit	38
Individual Mobilization Augmentee, drilling	26
Individual Mobilization Augmentee, no drilling	14

Source: OSD Reserve Affairs.

The total annual reserve physician team costs are shown in Table IV-10.

c. Physician Team Cost Using Active/Reserve Mix

The Services use a combination of active and reserve forces during wartime. A comparison of Tables IV-7 and IV-10 reveals that the peacetime costs of reserve

physician teams are considerably lower than those of active-duty physician teams. Table IV-11 shows the peacetime costs, by clinical area, using the active/reserve mix developed by the Wartime Medical Requirements Working Group.

Table IV-10. Total Annual Costs per Reserve Physician Team (FY90 Dollars)

Clinical Area	Army	Navy	Air Force
Internal Medicine	70,427	77,551	69,349
Dermatology	28,646	37,748	40,554
Neurology	33,759	39,857	47,297
General Surgery	85,603	67,518	69,572
Cardio/Thoracic Surgery	116,812	89,521	94,841
Neurosurgery	72,123	72,908	84,411
Ophthalmology	40,418	46,666	50,623
Oral Surgery	71,645	78,701	137,295
Otorhinolaryngology	72,832	53,006	87,721
Plastic Surgery	72,069	76,578	85,706
Urology	75,492	67,912	82,801
Neplurology	64,719	41,504	115,159
Gynecology	80,257	76,345	101,000
Orthopedics	100,719	81,492	86,168
Psychiatric Care	110,095	120,960	178,400

Table IV-11. Total Annual Costs per Physician Team Using Active/Reserve Mix (FY90 Dollars)

Clinical Area	Army	Navy	Air Force
Internal Medicine	260,732	497,615	627,156
Dermatology	103,527	236,270	359,997
Neurology	122,764	250,082	422,558
General Surgery	317,836	431,247	629,222
Cardio/Thoracic Surgery	435,263	575,355	863,673
Neurosurgery	267,115	466,551	766,906
Ophthalmology	147,820	294,681	453,417
Oral Surgery	265,316	504,486	1,257,557
Otorhinolaryngology	269,782	336,199	797,614
Plastic Surgery	266,911	490,582	778,913
Urology	279,793	433,826	751,963
Nephrology	239,257	260,872	1,052,185
Gynecology	297,719	489,058	920,813
Orthopedics	374,711	522,772	783,205
Psychiatric Care	409,991	781,263	1,638,932

d. Total Cost of the Casualty-Based Medical Requirement

Table IV-12 and Figure IV-1 give the Service totals for maintaining, in peacetime, the physician teams to satisfy the casualty-based wartime requirement. These totals are based on the active/reserve mix developed by the Wartime Medical Requirements Working Group. The DoD total is $1.23 billion, of which the Army accounts for 42%. The overall theater requirement represents 88% of the casualty-based total, while the CONUS requirement represents only 12%.

Table IV-12. Peacetime Cost of Casualty-Based Requirements, by Location and Service (Thousands of FY90 Dollars)

	Theater	CONUS	Casualty-Based Total
Army	413,166	97,285	510,451
Navy	328,509	39,263	367,772
Air Force	336,219	13,519	349,738
Total	1,077,894	150,067	1,227,961

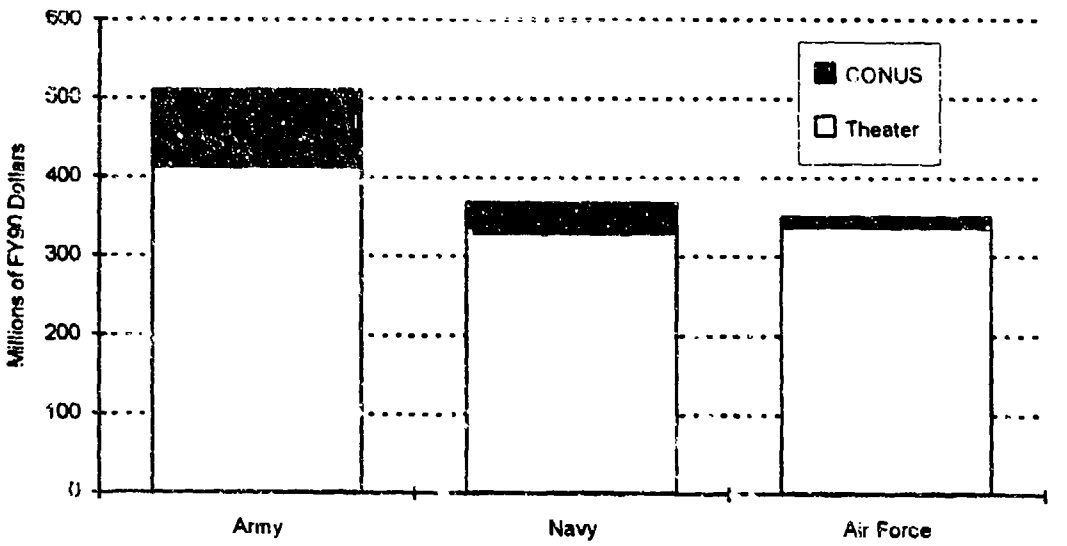

Figure IV-1. Peacetime Cost of Casualty-Based Requirements, by Location and Service

B. PEACETIME COST OF THE WARTIME MEDICAL STRUCTURE

1. Scope of the Wartime Medical Structure

The report of the Wartime Requirements Working Group defines the wartime medical structure as follows[6]:

> The second category of resources is made up of medical personnel who serve outside the hospital system. These physicians-who constitute the *structure-based requirement*-usually are attached to combat units or serve in outpatient clinics. Examples include doctors assigned to Army divisions, naval ships, the medical evacuation system, and headquarters staffs.

Two approaches are possible to quantifying the peacetime resources associated with the wartime medical structure. The Working Group's approach was to elicit from each Service a detailed list of *requirements* for structural medical personnel. This process resulted in a voluminous list that included not only personnel associated with combat and combat-support units, but also those associated with peacetime training, administration, research and development, and Service headquarters.

Our approach was based, instead, on selecting a subset of the fully and partially medical program elements already identified in Chapter II. The selection process, described in more detail in the next subsection, attempts to identify medical personnel associated in *peacetime* either with combat or combat-support units, or with management headquarters in operational commands.

The two approaches answer somewhat different questions, and neither is demonstrably superior to the other. The major distinctions between the two approaches are as follows:

- The Working Group's approach is based on requirements, whereas our approach is based on medical personnel actually assigned during peacetime. Thus, our approach aligns closely with budget data; the Working Group's approach does not, because unfunded requirements are not reflected in budget data.

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6 "Wartime Medical Requirements Study in Response to Section 733, National Defense Authorization Act for Fiscal Year 1992, 1993: Executive Summary (U)," Department of Defense, Office of the Director (Program Analysis and Evaluation). Secret, January 1994.

- The Working Group enumerated the medical personnel associated with the wartime structure requirement, but did not attempt to estimate the peacetime cost of these personnel. In principle, it would be possible to estimate the cost of these personnel, although that was not part of the Working Group's mandate. Our approach, based on budget data from the FYDP, estimates the cost of the medical personnel almost automatically.
- We employed a more conservative definition of medical structure, largely omitting categories such as peacetime training, administration, research and development, and Service headquarters. We omitted these categories because it proved impossible to isolate the *wartime* components of the corresponding program elements using budget data alone.

The next subsection describes the algorithm for selecting the structural Program Elements. The succeeding subsection estimates the peacetime costs of the medical resources found in these Program Elements. Finally, the structural costs may be added to the casualty-based costs, yielding an estimate of the total peacetime cost of the wartime medical requirement.

2. Selection of Structural Program Elements

We used the Program Element (PE) descriptions in the "Program Element Dictionary"[7] and the decision process graphically portrayed in Figure IV-2.

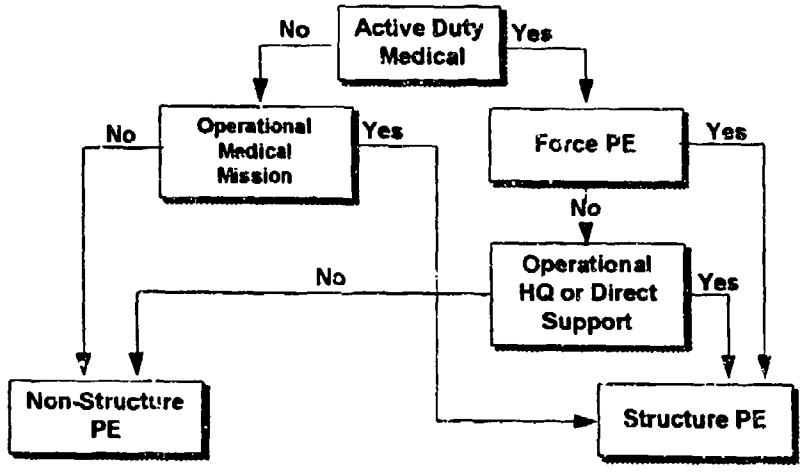

Figure IV-2. Decision Process for Identifying Structure-Based PEs

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7 "Department of Defense FYDP Program Structure," Office of the DoD Comptroller, Publication DoD 7045.7-H, April 1992.

We screened some 500 medical PEs identified in Chapter II, and partitioned them based on whether or not they contained active-duty medical personnel. From those containing active-duty medical personnel, we selected PEs relating to force units or combat weapon-platforms [e.g., PE 0202011A (Army Divisions), PE 0204222N (Destroyers—Missile), and PE 207133F (F-16 Squadrons)]. We also chose PEs that directly support the force [e.g., PE 0206215M (Force Service Support Group) and PE 0202017A (Tactical Support--Medical Units)]. Finally, at the recommendation of the Services, we included PEs for Management Headquarters in operational commands [e.g., PE 0201898A/F/N (Management Headquarters—U.S. Central Command, for Army, Air Force, Navy, respectively)]. In the case of Management Headquarters PEs, we included the costs of medical personnel who manage the wartime planning and deployment of the medical units.

For the PEs that do not contain active-duty medical personnel (primarily Reserve Component PEs), we selected those that appeared to have a medical mission in direct support of operational forces [e.g., PE 0508997A (Medical Support Units—Army Reserve), and PE 0508222F (Aeromedical Evacuation Units—Air National Guard)]. Listings, by Service, of the all the PEs we classified as structure-based, along with their associated medical costs, are contained in Tables IV-13 through IV-15.

As can be seen from our PE selection, our definition of wartime structure was fairly conservative. With certain exceptions, we tried to limit our selection to those personnel or organizations with the mission of providing medical care at echelons 1 or 2. We deliberately omitted PEs whose resources might support the casualty-based wartime requirement (e.g., PE 0807711A/F/N, Care in Regional Defense Facilities) or those that fall into the area of medical infrastructure (e.g., training, administration, research and development, or Service headquarters).

3. Cost Estimates

Several points should be emphasized regarding the "Medical Costs" shown in Tables IV-13 through IV-15. For COMA fully-medical PEs, we counted not only the military-pay costs of active-duty medical personnel, but also all other costs in that PE, *except* those for procurement of major end-items of military equipment (e.g., Aircraft Procurement). The non-pay costs are reported in the "Other" column of Tables IV-13 through IV-15. For example, we included six Reserve Component, fully-medical PEs

Table IV-13. Army Wartime Structure Program Elements (Millions of FY90 Dollars)

PE	Title	Active-Duty Medical Personnel			Medical Costs		
		Officer	Enlisted	Total	Active-Duty Medical Pay	Other	Total
0201113A	U.S. European Command (USEUCOM) Activities	0	1	1	$0.033		$0.033
0201298A	Management Headquarters (LANTCOM)	1	0	1	$0.045		$0.045
0201398A	Management Headquarters (USEUCOM)	3	0	3	$0.173		$0.173
0201598A	Management Headquarters (SOUTHCOM)	4	0	4	$0.293		$0.293
0201898A	Management Headquarters (CENTCOM)	3	0	3	$0.207		$0.207
0202011A	Divisions	1,010	9,037	10,047	$298.997		$298.997
0202012A	Non-Divisional Combat Brigades/Regiments	90	1,004	1,094	$31.278		$31.278
0202013A	*Other Non-Divisional Combat Units*	54	717	771	$21.383		$21.383
0202014A	Tactical Support—Other Units	37	189	226	$7.595		$7.595
0202016A	Tactical Support—Intelligence Units	5	23	28	$0.951		$0.951
0202017A	Tactical Support—Medical Units	517	4,269	4,786	$141.034	$140.668	$281.702
0202018A	Tactical Support—Logistics Units	47	175	222	$7.315		$7.315
0202019A	Tactical Support—Administrative Units	1	63	64	$1.669		$1.669
0202020A	Tactical Support—Maintenance of Tactical Equipment	4	16	20	$0.599		$0.599
0202081A	Theater Air Defense Forces	2	7	9	$0.383		$0.383
0202082A	Theater Missile Forces	6	118	124	$3.252		$3.252
0202085A	*Theater Defense Forces*	27	245	272	$8.022		$8.022
0202091A	Intelligence Support	3	15	19	$0.631		$0.631
0202092A	Special Activities	0	33	33	$0.878		$0.878
0502924A	Tactical Support Forces (Nonaffiliated, Army Reserve)	0	3	3	$0.073		$0.073
0508997A	Medical Support Units (Army Reserve)	0	0	0	$0.000	$70.067	$70.067
0509992A	Reserve Readiness Support (Army Reserve)	90	147	237	$10.115		$10.115
	Total	1,904	16,062	17,966	$534.926	$210.735	$745.661

Table IV-14. Navy Wartime Structure Program Elements (Millions of FY90 Dollars)

PE	Title	Active-Duty Medical Personnel			Medical Costs		
		Officer	Enlisted	Total	Active-Duty Medical Pay	Other	Total
0101221N	Fleet Ballistic Missile System (FBMS)	0	53	53	$1.864		$1.864
0101222N	Support Ships (FBMS)	26	92	118	$4.318		$4.318
0101228N	Trident I	5	37	42	$1.796		$1.796
0101315N	FBM Control System—Communications	2	1	3	$0.168		$0.168
0201113N	U.S. European Command (USEUCOM) Activities	1	1	2	$0.113		$0.113
0201298N	Management Headquarters (LANTCON)	1	0	1	$0.088		$0.088
0201398N	Management Headquarters (USEUCOM)	1	0	1	$0.074		$0.074
0201498N	Management Headquarters (PACOM)	3	1	4	$0.344		$0.344
0201898N	Management Headquarters (CENTCOM)	1	1	2	$0.127		$0.127
0202698N	Management Headquarters (FORSCOM)	5	0	5	$0.443		$0.443
0204112N	Multi-Purpose Aircraft Carriers	157	640	797	$28.536		$28.536
0204134N	A-6 Squadrons	0	15	15	$0.378		$0.378
0204135N	A-7 Squadrons	0	6	6	$0.156		$0.156
0204136N	F/A-18 Squadrons	0	19	19	$0.498		$0.498
0204144N	F-14 Squadrons	0	22	22	$0.541		$0.541
0204152N	E-2 Squadrons	0	13	13	$0.326		$0.326
0204154N	Sea-Based Electronic Warfare Squadrons	0	14	14	$0.368		$0.368
0204155N	Shore-Based Electronic Warfare Squadrons	3	7	10	$0.435		$0.435
0204156N	Readiness Squadrons	12	27	39	$1.899		$1.899
0204220N	Battleships	12	79	91	$3.243		$3.243
0204221N	Cruisers	9	130	139	$4.393		$4.393
0204222N	Destroyers—Missile	0	58	58	$1.758		$1.758
0204223N	Destroyers—Non-Missile	2	86	88	$2.795		$2.795
0204224N	Frigates—Missile	0	71	71	$2.151		$2.151
0204225N	Frigates—Non-Missile	0	75	75	$2.360		$2.360
0204226N	Patrol Combatants	0	2	2	$0.066		$0.066
0204227N	Support Forces	62	209	271	$9.684		$9.684
0204233N	SH-3 Squadrons	0	14	14	$0.368		$0.368
0204234N	S-3 Squadrons	0	12	12	$0.349		$0.349

Table IV-14. Navy Wartime Structure Program Elements (Continued)
(Millions of FY90 Dollars)

PE	Title	Active-Duty Medical Personnel			Medical Costs		
		Officer	Enlisted	Total	Active-Duty Medical Pay	Other	Total
0204251N	ASW Patrol Squadrons	17	64	81	$2.926		$2.926
0204262N	Readiness Squadrons (ASW)	12	42	54	$2.167		$2.167
0204281N	Submarines	0	106	106	$3.923		$3.923
0204282N	Support Forces	52	209	261	$8.927		$8.927
0204302N	Mine Countermeasure Forces	0	10	10	$0.350		$0.350
0204303N	Air Mine Countermeasures Squadrons	2	4	6	$0.283		$0.283
0204311N	Undersea Surveillance Systems	0	2	2	$0.056		$0.056
0204411N	Amphibious Assault Ships	77	546	623	$19.872		$19.872
0204412N	Amphibious Support Ships	5	20	25	$0.858		$0.858
0204413N	Amphibious Tactical Support Units (Displacement)	1	25	26	$0.919		$0.919
0204424N	Explosive Ordnance Disposal Forces	3	15	18	$0.722		$0.722
0204441N	Underway Replenishment Ships	30	157	187	$6.313		$6.313
0204451N	Major Fleet Support Ships	11	30	41	$1.590		$1.590
0204452N	Minor Fleet Support Ships	0	26	26	$0.880		$0.880
0204453N	Direct Support Squadrons—Aircraft	8	34	42	$1.549		$1.549
0204454N	Special Combat Support Forces	1	6	7	$0.265		$0.265
0204455N	Naval Construction Forces	15	86	101	$3.387		$3.387
0204577N	Relocatable Over-the-Horizon Radar (ROTHR)	0	2	2	$0.072		$0.072
0204631N	Operational Headquarters (Fleet)	3	3	6	$0.462		$0.462
0204652N	Operational Headquarters (Sea Control/Projection)	34	1	35	$2.549		$2.549
0204654N	Operational Headquarters (Sea Control/Air)	7	0	7	$0.593		$0.593
0204655N	Operational Headquarters (Sea Control/Surface)	18	47	65	$3.507		$3.507
0204656N	Operational Headquarters (Sea Control/Subsurface)	20	30	50	$2.654		$2.654
0204698N	Management Headquarters (Fleet)	15	9	24	$1.746		$1.746
0204798N	Management Headquarters (Sea Control/Projection)	6	2	8	$0.688		$0.688
0204898N	Management Headquarters (Surface)	4	12	16	$0.934		$0.934
0204998N	Management Headquarters (Subsurface)	2	2	4	$0.356		$0.356

Table IV-14. Navy Wartime Structure Program Elements (Continued)
(Millions of FY90 Dollars)

PE	Title	Active-Duty Medical Personnel			Medical Costs		
		Officer	Enlisted	Total	Active-Duty Medical Pay	Other	Total
0206125M	Helicopter Combat Support (MAW)	13	36	49	$1.835		$1.835
0206126M	Tactical Combat Support (MAW)	75	317	392	$14.286		$14.286
0206211M	Divisions (Marine)	126	2066	2192	$62.060		$62.060
0206315M	Force Service Support Group (FSSG)	289	1699	1988	$63.566		$63.566
0206498M	Management Headquarters (Fleet Marine Force)	9	12	21	$1.330		$1.330
0408036N	Sealift Enhancement (Surge)	11	40	51	$1.937	$3.702	$5.639
0502312N	A-6 Squadrons	0	2	2	$0.114		$0.114
0502313N	A-7 Squadrons	0	1	1	$0.064		$0.064
0502319N	F-14 Squadrons	0	2	2	$0.129		$0.129
0502332N	SH-3 Squadrons	0	2	2	$0.123		$0.123
0502338N	LAMPS	0	3	3	$0.181		$0.181
0502341N	ASW Patrol Squadrons	0	14	14	$0.862		$0.862
0502351N	Frigates—Missile	0	30	30	$0.955		$0.955
0502352N	Frigates--Non-Missile	0	18	18	$0.583		$0.583
0502359N	Mine Countermeasures Forces	0	16	16	$0.589		$0.589
0502360N	Air Mine Countermeasure Squadrons	0	2	2	$0.114		$0.114
0502366N	Amphibious Assault Ships	0	6	6	$0.183		$0.183
0502372N	Inshore Undersea Warfare Forces	0	2	2	$0.056		$0.056
0502374N	Explosive Ordnance Disposal Forces	0	2	2	$0.129		$0.129
0502378N	Minor Fleet Support Ships	0	8	8	$0.248		$0.248
0502379N	Direct Support Squadrons	0	1	1	$0.059		$0.059
0502380N	Special Combat Support --Cargo Handling	0	1	1	$0.070		$0.070
0502384N	Naval Construction Forces	0	3	3	$0.198		$0.198
0502514M	Force Service Support Group (Marine Corps Reserve)	11	105	116	$4.028		$4.028
1100611N	Ongoing Operational Activities--Active	7	166	173	$5.666		$5.666
1100611N	Ongoing Operational Activities--Reserve	0	4	4	$0.132		$0.132
1120011N	Training—Active	2	21	23	$0.905		$0.905
	Total	1,188	7,754	8,942	$298.589	$3.702	$302.291

Table IV-15. Air Force Wartime Structure Program Elements
(Millions of FY90 Dollars)

PE	Title	Active-Duty Medical Personnel			Medical Costs		
		Officer	Enlisted	Total	Active-Duty Medical Pay	Other	Total
0101113F	B-52 Squadrons	0	4	4	$0.100		$0.100
0101128F	B-52 Conventional Squadrons	0	2	2	$0.048		$0.048
0101142F	KC-135 Squadrons	5	13	18	$0.654		$0.654
0101898F	Management Headquarters (USSTRATCOM)	16	22	38	$2.367		$2.367
0102116F	Air Defense F-15	1	1	2	$0.122		$0.122
0102498F	Management Headquarters (Space Command)	4	2	6	$0.490		$0.490
0102898F	Management Headquarters (Strategic Defensive Forces)	0	2	2	$0.091		$0.091
0201113F	U.S. European Command (USEUCOM) Activities	0	2	2	$0.078		$0.078
0201398F	Management Headquarters (USEUCOM)	1	0	1	$0.086		$0.086
0201498F	Management Headquarters (PACOM)	2	1	3	$0.219		$0.219
0201598F	Management Headquarters (SOUTHCOM)	1	1	2	$0.125		$0.125
0201898F	Management Headquarters (CENTCOM)	2	0	2	$0.202		$0.202
0207128F	F-4 Squadrons	2	3	5	$0.273		$0.273
0207129F	F-111 Squadrons	5	11	16	$0.732		$0.732
0207130F	F-15A/B/C/D Squadrons	16	28	44	$2.061		$2.061
0207131F	A-10 Squadrons	13	27	40	$1.791		$1.791
0207133F	F-16 Squadrons	21	41	62	$2.654		$2.654
0207134F	F-15E Squadrons	3	2	5	$0.285		$0.285
0207136F	Manned Destructive Suppression	1	4	5	$0.205		$0.205
0207141F	F-117A Squadrons	2	5	7	$0.301		$0.301
0207213F	RF-4 Squadrons	4	3	7	$0.419		$0.419
0207222F	KC-10A	0	3	3	$0.072		$0.072
0207236F	Operational Headquarters (Tactical Air Forces)	21	9	30	$1.920		$1.920
0207252F	EF-111 Squadrons	2	8	10	$0.344		$0.344
0207253F	Compass Call	1	8	9	$0.271		$0.271
0207314F	Ground Launched Cruise Missile	3	12	15	$0.595		$0.595
0207412F	Tactical Air Control System	0	26	26	$0.823		$0.823

Table IV-15. Air Force Wartime Structure Program Elements (Continued) (Millions of FY'90 Dollars)

PE	Title	Active-Duty Medical Personnel			Medical Costs		
		Officer	Enlisted	Total	Active-Duty Medical Pay	Other	Total
0207417F	Airborne Warning and Control System (AWACS)	6	16	22	$0.997		$0.997
0207418F	Tactical Airborne Control Systems	3	6	9	$0.323		$0.323
0207419F	Tactical Airborne Command and Control Systems	1	2	3	$0.168		$0.168
0207430F	Civil Engineer Squadrons (Heavy Repair)	0	8	8	$0.244		$0.244
0207593F	Chemical/Biological Defense Program	0	2	2	$0.072		$0.072
0401115F	C-130 Airlift Squadron	9	20	29	$1.173		$1.173
0401124F	Aeromedical Airlift Squadrons (Industrially Funded)	0	0	0	$0.000	$0.085	$0.085
0504216F	Aeromedical Evacuation Units (AFR—Associate)	0	0	0	$0.000	$5.569	$5.569
0504345F	C-130 Tactical Airlift Squadrons (Air Force Reserve)	1	0	1	$0.046		$0.046
0508211F	Medical Service Units (Air Force Reserve)	1	2	3	$0.153	$21.685	$21.838
0508212F	Aeromedical Evacuation Units (Air Force Reserve)	0	0	0	$0.000	$38.581	$38.581
0508213F	Medical Mobilization Augmentees (Air Force Reserve)	0	0	0	$0.000	$11.202	$11.202
0508221F	Medical Readiness Units (Air National Guard)	0	0	0	$0.000	$44.576	$44.576
0508222F	Aeromedical Evacuation Units (Air National Guard)	0	0	0	$0.000	$10.420	$10.420
1100011F	Ongoing Operational Activities—Active	4	12	16	$0.627		$0.627
1120011F	Training—Active	2	0	2	$0.143		$0.143
1180098F	Management Headquarters (SOFCOM)	1	0	1	$0.086		$0.086
	Total	154	308	462	$21.360	$132.118	$153.478

relating to Air Force aeromedical evacuation,[8] all of which contain small numbers of active-duty medical personnel, but much larger appropriations for Reserve Military Personnel and Operations and Maintenance (O&M).

We counted only the military-pay costs of active-duty medical personnel for the partially medical PEs. No attempt was made to allocate to the medical mission the costs of other appropriations in these PEs, hence only the "Active-Duty Medical Pay" columns have entries in Tables IV-13 through IV-15. We applied the same procedure to the non-COMA PEs that both were identified as containing medical personnel in Chapter II, and satisfied our criteria for inclusion in the wartime structure. Finally, note that the medical personnel that we identified represent assignments at a given point in time (30 September 1990), and need not correspond to the authorized strength or required manning during wartime.

Figure IV-3 shows the estimates of structural cost for each Service. The Army estimate is nearly $750 million, of which $535 million (72%) is composed of active-duty pay. The non-active-duty costs appear exclusively in two program elements, PE 0202017 (Tactical Support—Medical Units) and PE 0508997 (Medical Support Units—Army Reserve). The Navy structural estimate is $302 million, of which all but $3.7 million is active-duty pay. Finally, the Air Force structural estimate is $153 million, of which only $21 million is active-duty pay. The non-active-duty costs ($132 million) appear in the six Reserve Component PEs mentioned previously, plus PE 0401124 (Aeromedical Airlift Squadrons).

A complete accounting of the wartime medical requirement clearly requires an estimate of the wartime medical structure. However, although two different reports (the current report as well as that of the Wartime Medical Requirements Working Group) have attempted to enumerate the wartime medical structure, the concept still lacks a rigorous, official definition. Because a precise definition must precede precise estimation, further research into the definition of the wartime structure appears to be warranted.

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[8] The six PEs in question are: PE 0504216F [Aeromedical Evacuation Units, Air Force Reserve (AFR) Associate], PE 0508211F (Medical Service Units, AFR), PE 0508212F (Aeromedical Evacuation Units, AFR), PE 0508213F (Medical Mobilization Augmentees, AFR), PE 0508221F [Medical Readiness Units, Air National Guard (ANG)], and PE 0508222F (Aeromedical Evacuation Units, ANG).

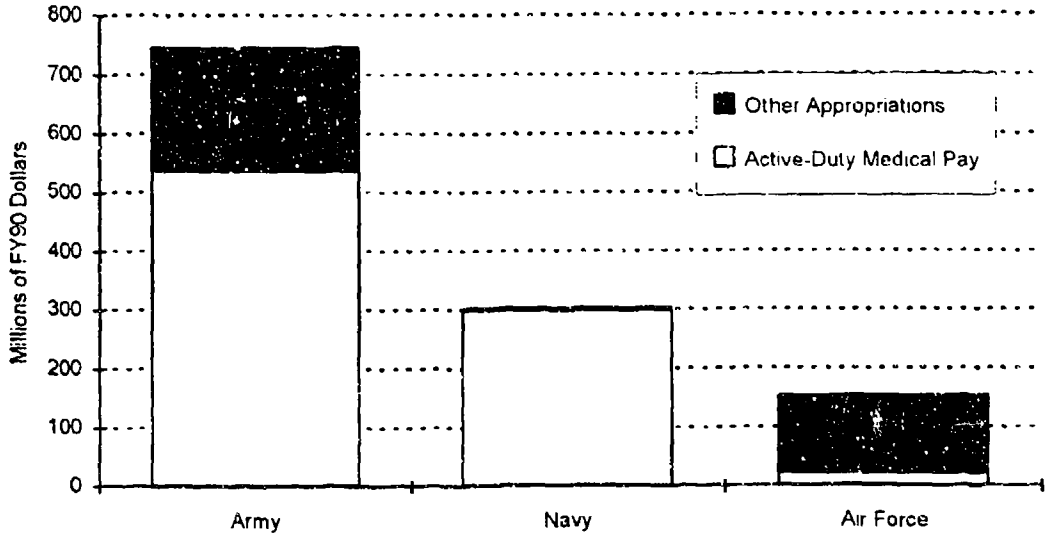

Figure IV-3. Peacetime Cost of Wartime Medical Structure, FY90

C. TOTAL PEACETIME COST OF THE WARTIME MEDICAL REQUIREMENT

Table IV-16 and Figure IV-4 present our estimates of the total peacetime cost of the wartime medical requirement. The structural and casualty-based components are roughly equal, each about $1.2 billion. The Army accounts for 52% of the DoD total of $2.43 billion, the Navy accounts for 28%, and the Air Force accounts for the remaining 20%. Finally, the DoD wartime total of $2.43 billion represents 15.6% of the total FY90 medical expenditure of $15.6 billion estimated in Chapter II (Table II-8).

Table IV-16. Total Peacetime Cost of Wartime Medical Requirements, by Location and Service (Thousands of FY90 Dollars)

		Casualty-Based		
	Structure	Theater	CONUS	Total
Army	745,661	413,166	97,285	1,256,112
Navy	302,291	328,509	39,263	670,063
Air Force	153,478	336,219	13,519	503,216
Total	1,201,430	1,077,894	150,067	2,429,341

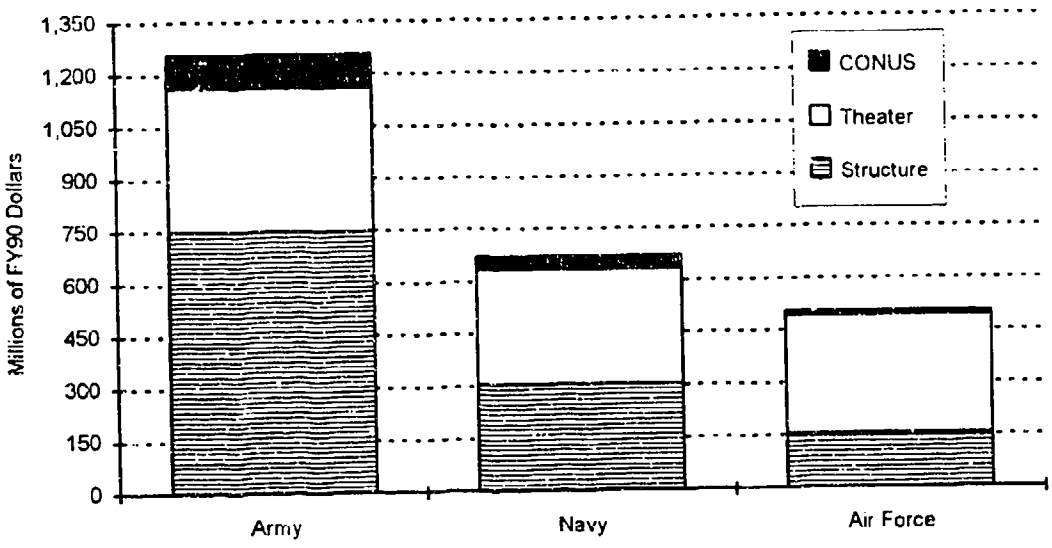

Figure IV-4. Total Peacetime Cost of Wartime Medical Requirements, by Location and Service

V. COST FUNCTIONS FOR MILITARY HOSPITALS

This chapter discusses the military treatment facility (MTF) cost functions used to project the total cost of providing care at DoD hospitals under several analytical cases. These cases will be described further in Chapter VI. The cost functions estimate the total costs of operating each individual facility, given projections of inpatient and ambulatory workload at each facility, the capacity of each facility measured in terms of operating beds, and the number of residents and interns enrolled in each facility's Graduate Medical Education (GME) program (where applicable). The facility-level costs are then summed over all facilities to estimate the system-wide costs of providing care at DoD hospitals under each analytical case. The costs of providing care within the civilian sector, and paid through the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS), are being separately estimated by the RAND Corporation.

To develop the cost functions, econometric modeling was applied to identify independent variables that explain the variation in cost across DoD hospitals. Several independent variables were considered, including workload performed, facility operating capacity, size of GME program, geographic location of the facility, and type of facility (i.e., medical center, community hospital, or free-standing ambulatory clinic). The existence of economies of scale and scope was also investigated. First we present a summary of the modeling methodology and try to identify the critical assumptions on which the analysis hinges. Then we present the estimated inpatient and ambulatory cost functions.

A. GENERAL METHODOLOGY

The cost functions were developed both to better understand the relationship between costs and workload within DoD hospitals and to project total facility costs for various levels of workload. The cost functions are based on adjusted Medical Expense and Performance Reporting System (MEPRS) data, as described in Chapter III. Most of the adjustment factors were based on analysis of FY90 MEPRS data, though there were a few

exceptions.[1] Our preliminary modeling efforts were based exclusively on FY90 data. When the Section 733 Study began, the data for FY92 were not yet complete. Moreover, the data for FY91 are widely viewed as anomalous because of Operation Desert Storm. As the study progressed and FY92 data became available, we began to combine these new data with the FY90 data. We found that the regression relationships between cost and workload were statistically indistinguishable for the two fiscal years, once we corrected for the escalation in unit cost. Thus, we were able to combine the two years of data, thereby doubling the sample size for the regression analysis with an attendant increase in the precision of our estimates.

Specifically, we escalated the FY90 expenses by the average increase in cost per unit workload (i.e., cost per inpatient discharge or cost per ambulatory visit) observed between FY90 and FY92. Separate escalation factors were applied to the inpatient and ambulatory expense data, and to each facility type (i.e., medical center, community hospital, or clinic[2]). These escalation factors are shown in Table V-1. The MEPRS adjustment factors, derived in Chapter III and repeated here in Table V-1, were applied to both the FY90 and FY92 MEPRS expense data. Then the escalation rates were applied only to the FY90 expenses, in order to express them in FY92 dollars.

Table V-1. Escalation Rates and MEPRS Adjustment Factors

	Inpatient Expenses	Ambulatory Expenses
FY90 to FY92 Cumulative Escalation Rate:		
Medical Centers	26.8%	27.3%
Community Hospitals	16.7%	23.5%
Clinics	Not Applicable	15.2%
MEPRS Adjustment Factors:		
Army	16.9%	13.2%
Air Force	12.8%	10.6%
Navy	13.3%	11.2%

1 The analysis of support-cost ratios used the time period FY87-FY90; the analysis of Military Construction appropriations used the time period FY89-FY92; the analysis of MEPRS pay factors used the single year FY91.

2 Note that the clinic escalation rate was computed after excluding Navy Medical Clinic (NMCL) Pearl Harbor and NMCL Port Hueneme. These two clinics were excluded because of their extreme year-to-year cost fluctuations, as well as their outlier status as determined by regression analysis. The two-year clinic escalation rate with these two data points included would have been only 6.2%.

The escalation rates shown in Table V-1 are surprisingly high. These are two-year cumulative rates, but the implied annual rates are still quite high (e.g., 12.6% for inpatient expenses in medical centers). These escalation rates cannot be strictly interpreted as price indices for medical care, because rapid technological advance invalidates the concept of comparing prices for a constant set of goods or services. In addition, some of the FY92 outlays may represent the spend-out of FY91 obligations made in connection with Operation Desert Storm.

The MEPRS cost-assignment methodology separates cost and workload into inpatient and ambulatory functional categories. To take advantage of the MEPRS methodology for allocating ancillary, support, and overhead costs to functional categories, we developed separate inpatient and ambulatory cost functions. The predictions of the two models may simply be added to predict total cost at a given facility. We also experimented with a model to predict combined inpatient and ambulatory costs, using separate inpatient and ambulatory workload measures as independent variables. However, we found a high correlation between the inpatient and ambulatory workload measures across facilities. The combined model suffered from unstable coefficient estimates as compared to the separate inpatient and ambulatory models reported here.

The cost models also required a weighting process to adjust for heteroskedasticity (i.e., non-uniform error variance within groups) as well as groupwise variance differences (i.e., differences in relative modeling error between medical centers, community hospitals and clinics). Through the use of weighted regression, with additional adjustments for groupwise differences, the basic assumption of constant variance (homoskedasticity) in the data was restored when applying least squares regression.

To better establish a baseline from which to construct military-hospital cost models, we reviewed previous work by Vector Research, Incorporated (VRI) on military-hospital cost functions, as well as numerous research publications on civilian-hospital cost functions. These papers aided in identifying potential independent variables that were considered for the cost functions. Table V-2 summarizes the findings contained in these papers.

We have summarized the procedure for developing the facility-level expenses used as the dependent variable in the cost functions, as well as the procedure for identifying potential independent variables. The remainder of this chapter describes the resulting inpatient and ambulatory cost functions.

Table V-2. Summary of Civilian-Hospital Cost Function Research

- Most models are specified in the form of a log-log model (1, 3, 7), (others used were general linear-with scale and scope terms-or translog models).
- Teaching activity significantly contributes to higher total costs (1, 2, 3, 5, 6, 7).
- Diminishing marginal costs generally exist for hospitals having up to 300 beds (1, 2, 3, 5, 7)
- Outpatient visits by clinical area generally do not have significantly different cost coefficients (1, 3).
- Economies of scope exist between pediatric care and other inpatient care (2).
- Diseconomies of scope exist between emergency room services and inpatient care (1, 2, 7).
- Level of forecasted workload has a significant effect on costs (if forecasted workload is higher than realized workload, then incur excess capacity costs) (3, 4, 5, 7).
- Specialty care may be more expensive than general medical care even after case-mix adjustment (1, 3, 5).
- Inpatient care is frequently separated into discharges and bed days to measure the impact of changes in average length of stay (1, 3, 7).

Note: The numbers refer to formal references, listed below, from which the statements were derived.

1. Thomas W. Grannemann, Randall S. Brown, and Mark V. Pauly, "Estimating Hospital Costs-A Multiple Output Analysis," *Journal of Health Economics*, No. 5, 1986, 107-127.
2. Thomas G. Cowing and Alphonse G. Holtman, "Multiproduct Short-Run Hospital Cost Functions: Empirical Evidence and Policy Implications From Cross-Section Data," *Southern Economic Journal*, Volume 49, January 1983, 637-653.
3. Jack Hadley and Stephan Zuckerman, "Determinants of Hospital Costs-Outputs, Inputs, and Regulation In the 1980s," Urban Institute Report 91-10, 1991.
4. Bernard Friedman and Mark V. Pauly, "A New Approach to Hospital Cost Functions and Some Issues In Revenue Regulation," *Health Care Financing Review*, No. 4, March 1983, 105-114.
5. Mark V. Pauly and Peter Wilson, "Hospital Output Forecasts and the Cost of Empty Hospital Beds," *Health Services Research*, Volume 21, August 1986, 403-428.
6. Vector Research Incorporated, "Development of Cost Models to Support Diagnosis Related Management," VRI-DMIS-2.60 WP91-1R, 7 November 1991.
7. Kenneth E. Thorpe, "Why Are Urban Hospital Costs So High? The Relative Importance of Patient Source of Admission, Teaching, Competition, and Case Mix," *Health Services Research*, Volume 27:6, February 1988.

B. INPATIENT COST FUNCTION

Two cost functions were developed, one for inpatient expense data and one for ambulatory expense data. MEPRS separately identifies inpatient and ambulatory costs, and uses a standard methodology for assigning ancillary, support, and overhead expenses to each clinical area within the hospital. The inpatient cost function, based on expenses reported in the MEPRS A (Inpatient) accounts, is described next. The ambulatory cost function is discussed in a later section.

1. Construction of Case-Mix Adjusted Workload

The objective of this section is to develop a single, homogeneous work unit for inpatient care. It is well-known that different clinical procedures vary widely in resource

intensity. Simply adding the total number of discharges, without regard to the procedures performed, would not yield a homogeneous work unit even for a single facility. Moreover, it would be virtually impossible to compare unit costs across facility types. For example, community hospitals refer many of their most difficult cases to medical centers, so medical centers would always appear more expensive unless some adjustment were made for complexity.

Our homogeneous work unit uses a weighting scheme for resource intensity based on Diagnosis Related Groups (DRGs). The DRG system provides a method for classifying inpatient care into over 500 groups having roughly similar within-group resource requirements. DRGs form the basis for prospectively determining hospital payments within the Medicare and CHAMPUS programs. By following a DRG schedule, hospitals that treat the more resource-intensive cases are credited with larger payments. We have applied DRGs in a reverse fashion from their conventional usage. We observe differences in unit costs across MTFs. We have used DRGs to rationalize part of these differences, effectively crediting the medical centers with more work units.

Specifically, we assigned individual inpatient discharges from military hospitals to particular DRGs, based on the inpatient record abstracts contained in each Service's Biometrics database as reported in the Defense Medical Information System (DMIS). The DRG assignments are determined by information on diagnoses, procedures performed, comorbidities and complications, and other factors. However, because (as mentioned in Chapter III) military hospitals do not have a patient-level accounting system, it is not possible to directly estimate an average cost by DRG for military hospitals. Instead, we used the CHAMPUS FY91 (Version 8) DRG Grouper, with its associated average costs and outlier criteria.[3] The assumption here was that *relative* cost by DRG based on CHAMPUS experience provides a good predictor for (unobserved) relative cost by DRG in military hospitals.

Table V-3 presents a simplified, fictional example to illustrate how DRG-based case-mix adjustments work. In the example, a vaginal delivery is accompanied by either a

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[3] CHAMPUS FY91 (Version 8) DRG weights and outlier criteria were published in the *Federal Register*, Vol. 55, No. 214, November 5, 1990. These weights are based on CHAMPUS hospital claims for the period 1 July 1989 through 30 June 1990. For the few DRGs for which CHAMPUS weights were not available, we substituted Health Care Financing Administration (HCFA) weights for FY91, deflated by a factor of 1.1976.

normal newborn or a low-birthweight newborn, yielding a total of two discharges. The table demonstrates that the cost per discharge prior to case-mix adjustment ranges between $400 and $40,000. Because high-risk deliveries are typically identified in advance and referred to medical centers, a preponderance of low-birthweight infants are delivered in medical centers. Thus, prior to case-mix adjustment, one would expect a higher average cost per discharge at medical centers than at community hospitals.

Table V-3. Derivation of DRG Weights

DRG	Description	Total Cost	Total Discharges	Cost per Unadjusted Discharge	DRG Weight	Cost per DRG Weight
373	Vaginal Delivery	$14,240,000	5,000	$2,848	0.712	$4,000
391	Normal Newborn	$1,760,000	4,400	$400	0.100	$4,000
610	Low Birthweight Newborn	$24,000,000	600	$40,000	10.000	$4,000
	Total/Average:	$40,000,000	10,000	$4,000	1.000	$4,000

Continuing with this example, Table V-3 compares average costs before and after case-mix adjustment. The DRG weight is computed in each row of the table as the ratio of cost per unadjusted discharge, divided by the overall average cost (i.e., divided by $4,000). We see that average cost is equalized after application of the DRG weights, so that the cost and workload data at medical centers may be combined with the data from community hospitals, which are less likely to treat high-risk cases. For example, vaginal delivery (DRG 373), most likely performed at a community hospital, is counted in our data as 0.712 weighted discharges. The average cost per *weighted* discharge equals $4,000. Low-birthweight neonatal care (DRG 610), most likely provided at a medical center, is counted in our data as 10.0 weighted discharges. The average cost per *weighted* discharge again equals $4,000. By expressing workload in terms of weighted discharges, we have work units that are equally costly on average. Thus, the weighted discharges may be added to form a homogeneous predictor of total inpatient cost at a given facility.[4]

We should reiterate the fundamental assumption of this section: the relative cost by DRG based on CHAMPUS experience provides a good predictor for relative cost by DRG

[4] In addition, for certain exceptional cases with extremely long or short stays, the DRG weight is not entirely appropriate. We have adjusted the weighted workload down for exceptionally short stays or up for exceptionally long stays. These adjustments were made in accordance with the outlier criteria and methodology used by CHAMPUS in FY91 for the Version 8 DRG Grouper.

in military hospitals. A direct computation of relative resource weights would require a patient-level accounting system for military hospitals, including a method for allocating overhead to individual discharges. Although this level of information is not currently available, further research may be warranted to investigate the adequacy of using CHAMPUS DRG weights as a proxy.

2. Preliminary Data Analysis

Figure V-1 shows the variation, across MTFs, in the percentage change in average inpatient cost that occurred between FY90 and FY92. Note that these are two-year *cumulative* percentage changes, and that the FY90 costs were escalated to FY92 dollars before computing the percentage change (thus the average percentage change across all MTFs is zero). At the extremes, some fifteen MTFs showed an increase of over 25%, while eight MTFs showed a decrease of over 25%. These large changes illustrate the difficulty in developing a model to predict the level of cost at a given facility. However, it is quite possible to develop a model that accurately predicts system-wide costs, as long as the errors from one MTF to another roughly cancel out.

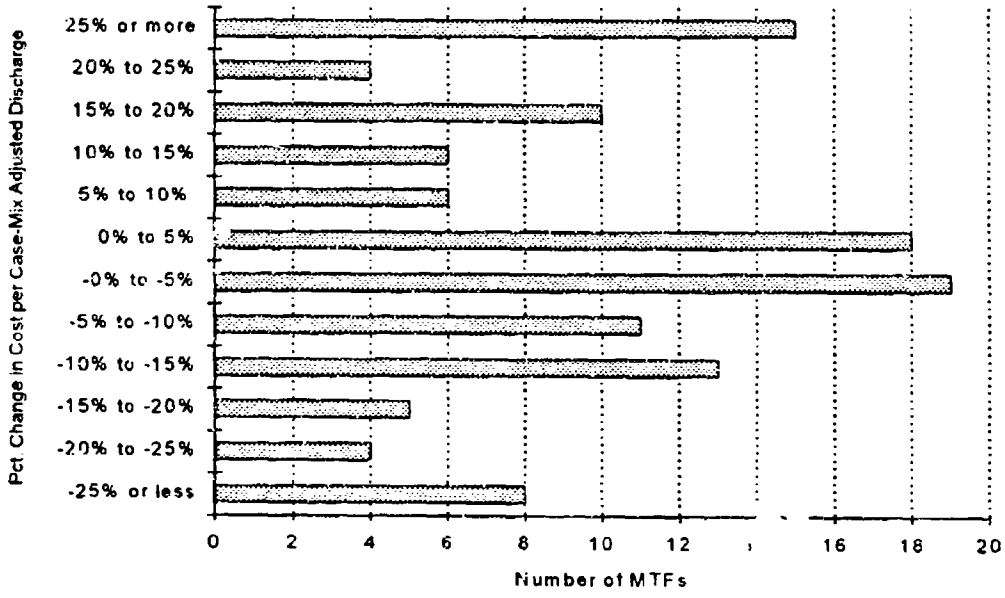


Figure V-1. Histogram of Percentage Change in Cost per Case-Mix Adjusted Discharge, FY90 to FY92 (Measured in FY92 Dollars)

Figures V-2 and V-3 highlight the variation in the *level* of cost per case-mix adjusted discharge, rather than the rate of growth. Again, both FY90 and FY92 costs are expressed in FY92 dollars. Of the 18 medical centers compared in FY92, 12 had average costs between $4,000 and $5,500 per case-mix adjusted discharge. Three medical centers had average costs above $6,000: Letterman Army Medical Center (AMC), Naval Hospital (NH) Oakland, and National Naval Medical Center (NNMC) Bethesda. FY92 data for Letterman AMC were removed from the model because workload was severely curtailed in preparation for closure. The increase in average cost at Letterman AMC resulted from spreading fixed costs over this declining workload. A similar phenomenon may have occurred at NH Oakland, which was scheduled for closure shortly after the period under examination here.

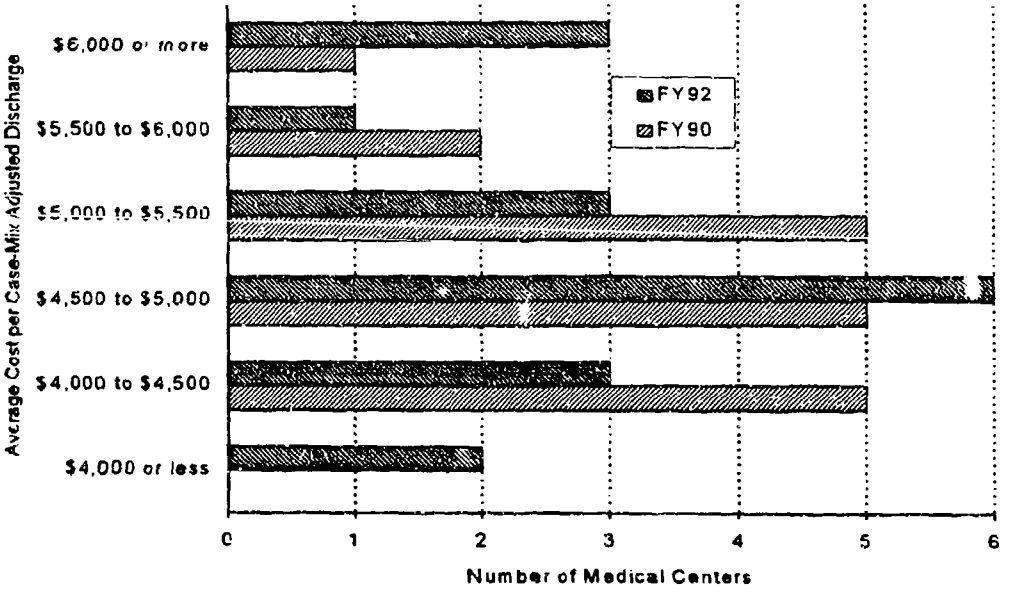


Figure V-2. Histogram of Average Medical-Center Cost per Case-Mix Adjusted Discharge (FY92 Dollars)

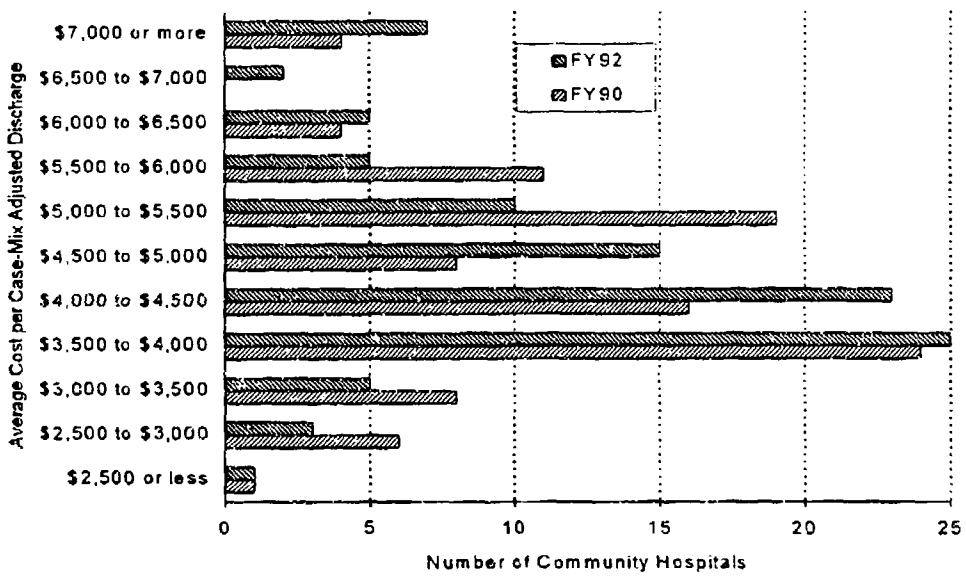


Figure V-3. Histogram of Average Community-Hospital Cost per Case-Mix Adjusted Discharge (FY92 Dollars)

3. Regression Estimates

The inpatient regression data appear in Appendix D. Figure V-4 displays the relationship between inpatient expenses (FY90 and FY92 data measured in FY92 dollars) and inpatient case-mix adjusted workload (i.e., the sum of weighted discharges by facility), with symbols identifying the facilities by type. The scatterplot demonstrates that medical centers in general are larger than community hospitals in terms of total inpatient workload. Where the two facility types overlap, roughly between 8,000 and 14,000 discharges, medical centers have higher costs than community hospitals. This visual analysis, reinforced with statistical tests, indicated fundamental differences between the cost structures of medical centers and community hospitals. These differences were taken into consideration in the model through the use of facility-type dummy variables, where required. Also, while the scatter of points for medical centers appears linear, the scatter for community hospitals indicates decreasing marginal costs for the largest hospitals. This phenomenon was modeled by introducing a quadratic term (i.e., workload squared) for the community hospitals only.

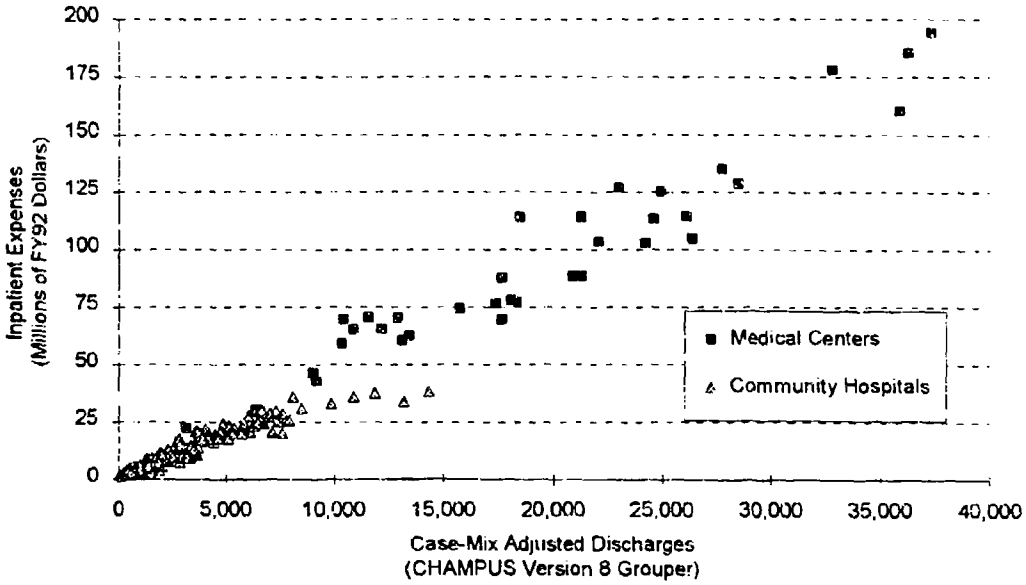


Figure V-4. FY90 and FY92 Inpatient Expenses (FY92 Dollars), by Facility Type

Figure V-5 visually demonstrates that the FY90 data points are well interspersed with the FY92 data points after application of the escalation rates. Thus the escalation rates we used seem to be appropriate. In addition, statistical tests indicated that the separate regression relationships for the two years were indistinguishable, thereby justifying our decision to combine them into a single cost function.

The sample composition and data exclusions are shown in Table V-4.

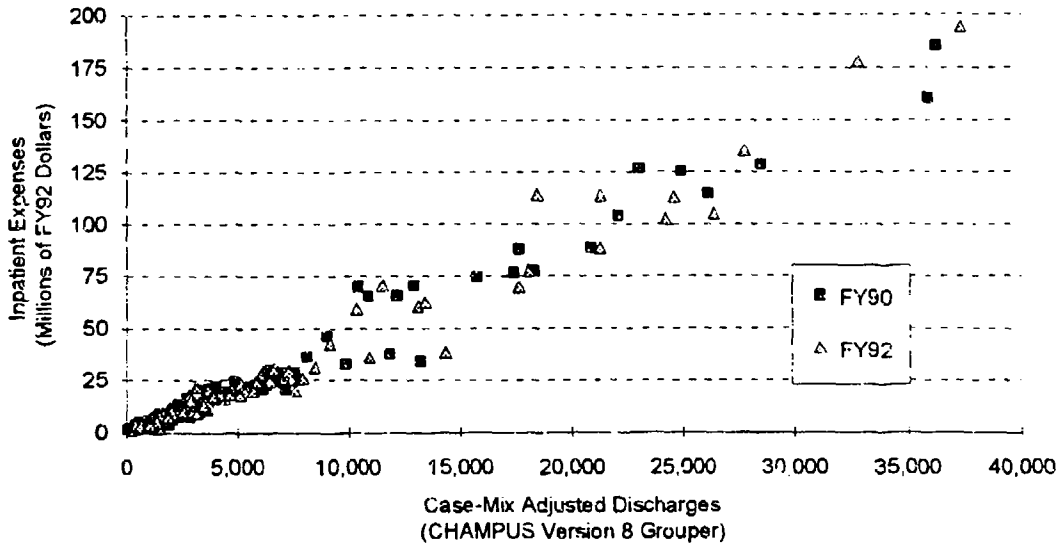


Figure V-5. FY90 and FY92 Inpatient Expenses (FY92 Dollars), by Fiscal Year

Table V-4. Sample Size for Inpatient Cost Model

Facility Type	FY90	FY92	Total
Medical Centers	18	17	35
Community Hospitals	97	95	192
Total	115	112	227

The following data points were removed from the model prior to estimation:

Facility Name	Fiscal Year	Reason
Letterman	FY92	Structural
Womack	FY90, FY92	High Leverage
NH Newport	FY92	Outlier
Cutler	FY90, FY92	Missing Data
BH NAVSTA Adak	FY92	Missing Data
509th Strategic Hospital	FY90, FY92	Missing Data
354th Medical Group	FY90, FY92	Missing Data

The inpatient cost-function parameter estimates and summary statistics are presented in Table V-5. As indicated by visual inspection of Figure V-4, the regression

function is linear for medical centers, but includes a quadratic effect (i.e., decreasing marginal costs) for community hospitals.[5] The model also reveals that facility operating capacity and GME intensity are significant predictors of inpatient expenses. Recall that operating capacity was measured by the number of operating beds, and GME intensity was measured by the number of residents and interns enrolled at an MTF. Recall also that we used FY92 reported operating beds for both fiscal years, because the FY90 reported operating-bed data were judged unreliable.

Table V-5. Final Inpatient Model

Model Functional Form:

Inpatient Expenses = (Intercept + Community Hospital Intercept Adjustment + B1*Case-Mix Adjusted Discharges + B2*Community Hospital Case-Mix Adjusted Discharges + B3*Community Hospital Case-Mix Adjusted Discharges Squared + B4*Operating Beds + B5*GME) * (1 + B6*Navy Adjustment)

Variables	Mean Value	Coefficient Estimate	t-Statistic	95% Confidence Interval	
Intercept		9,548,815	2.474	1,942,709	17,154,921
Community Hospital Intercept Adjustment		-8,467,472	-2.193	-16,076,618	-858,325
Case-Mix Adjusted (CMA) Discharges	5,321	2,979	7.990	2,244	3,714
Community Hospital CMA Discharges	2,314	+223	0.590	-523	969
Community Hospital CMA Discharges Squared	1.07e+7	-0.0601165	-2.728	-.1035426	-.0166905
Operating Beds	103	35,256	5.005	21,373	49,138
GME (Residents & Interns)	31	65,862	2.910	21,254	110,471
Navy Adjustment		7.36%	2.690	1.97%	12.76%

Notes: R-squared = 0.9814, adjusted R-squared = 0.9808, standard error of regression = $1.24M.

The coefficients are interpreted in the following manner:

- Intercept: The cost that would be predicted at a medical center if all regression variables were set to zero. Because medical centers are never observed in this situation, the confidence interval is extremely wide; the estimate involves extrapolation well outside the range of observed data. Moreover, the estimate

[5] The literature on civilian-hospital cost functions, as summarized previously in Table V-2, often uses more exotic mathematical functions than our linear-quadratic. For example, the translog function is sometimes used to account for sample variation in the prices of inputs such as labor and materials. We suspect that price variation across MTFs is minimal; the largest component of cost, military labor, shows no price variation at all. Consistent with this hypothesis, we found no evidence of geographical variation in total inpatient cost across MTFs. Therefore, we saw no need to consider the translog function.

is counterfactual because it considers a medical center with not only zero inpatient workload, but also zero bed capacity.

- Community Hospital Intercept Adjustment: The difference between the medical-center intercept and community-hospital intercept; the resulting community-hospital intercept is $1.08 million.
- Case-Mix Adjusted (CMA) Discharges: The marginal cost of producing an additional discharge at a medical center.
- Community Hospital CMA Discharges: The difference between the marginal cost of producing an additional discharge at a community hospital, versus the marginal cost of producing an additional discharge at a medical center, *prior* to adjusting for the diminishing marginal costs identified at the former. Thus, the marginal cost of the first discharge from a community hospital equals $2,979 plus $223, or $3,202. We retain the difference, $223, even though it is not statistically significant, because it represents our best point estimate.
- Community Hospital CMA Discharges Squared: The square of discharges is used as an independent variable to identify potential increasing or decreasing marginal costs with increases in workload. The negative coefficient implies that marginal costs decrease with an increase in workload (i.e., economies of scale).
- Operating Beds: Staffed beds that are ready to be occupied by patients (operating beds) are a measure of a hospital's operating capacity. The coefficient represents the cost of each staffed bed, and is a combination of fixed (i.e., physical plant) and marginal (i.e., staff) costs.
- GME (Residents and Interns): An estimate of the additional *patient-care* cost incurred by providing graduate medical education, measured in terms of cost per enrolled resident or intern. This estimate reflects student salaries charged directly to the MEPRS A (Inpatient) account. It also reflects classroom time factored into total expenses via the FAK-account (Student Expenses) adjustment, as described in Chapter III, so as to include all student salaries. Recall, however, that the FAK accounts were spread as system-wide overhead, rather than being assigned directly (and exclusively) to teaching facilities.
- Navy Adjustment: Due to structural and accounting differences, it was necessary to include a variable to distinguish Navy facilities from Army and Air Force facilities.

The Navy adjustment should *not* be interpreted as evidence that Navy hospitals are more expensive or less efficient than Army or Air Force hospitals. Although MEPRS purports to be a standardized accounting system, there are workload and cost-accounting

differences between the Services that cannot be explained through econometric modeling given the variables at hand. We expand on this point later in the section on ambulatory cost models. We present comparisons between medical workload as reported in the accounting systems, and medical workload as self-reported by beneficiaries in the 1992 DoD Health Care Survey. The accounting systems report more workload than the survey, but the difference is less pronounced for the Navy than for the other two Services. Thus, the accounting systems may understate Navy workload (or overstate it less), fostering the appearance of higher unit cost for that Service. Further research is clearly warranted to improve the comparability of cost and workload data across the three Services.

Inpatient marginal costs are constant with respect to workload for medical centers, but decrease over the range of data for community hospitals. The model estimates of marginal cost are depicted in Figure V-6. At a level of approximately 1,860 total discharges, the marginal cost of a discharge at a medical center is equal to the marginal cost of a discharge at a community hospital. Therefore, very small community hospitals appear to be most expensive on the margin. Marginal costs for community hospitals remain positive until the point of approximately 26,600 discharges. This level is substantially greater than the highest observed value of 14,363 discharges for community hospitals, and well beyond the relevant range of application of the cost function for community hospitals.

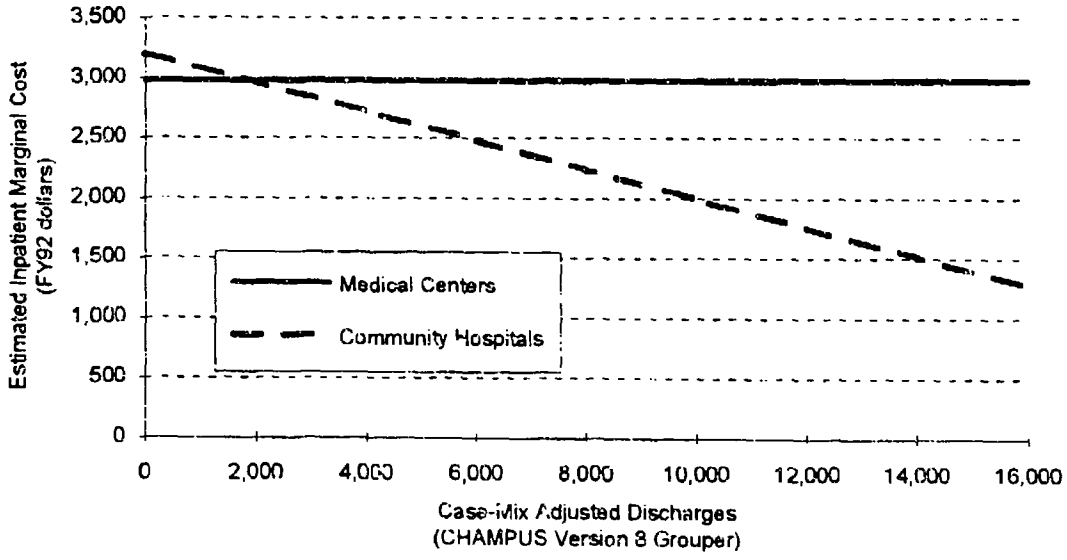
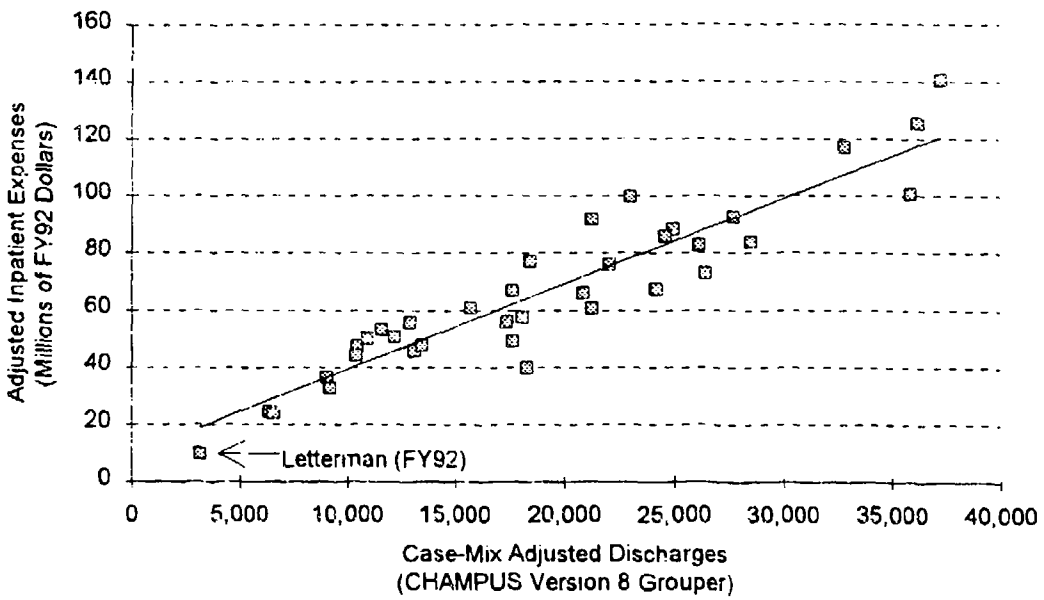


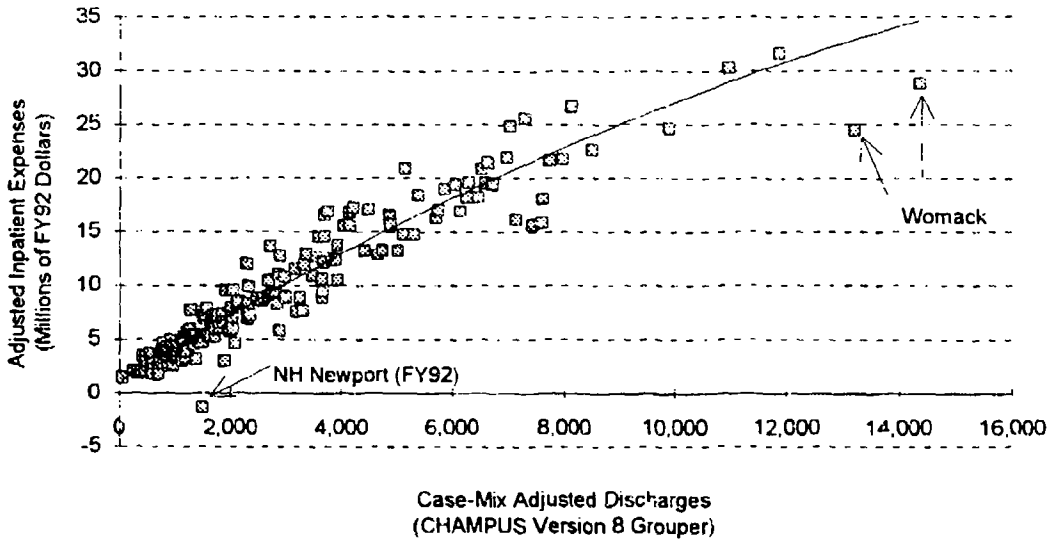
Figure V-6. Inpatient Marginal Cost Versus Workload, by Facility Type

Figures V-7 and V-8 display the relationship between total inpatient expenses and workload, respectively for medical centers and community hospitals, after adjusting for all independent variables other than case-mix adjusted discharges. As shown previously in Table V-4, several data points were excluded from the model for various reasons. In particular, Womack Army Community Hospital (ACH) at Fort Bragg, North Carolina, was excluded because this facility had undue influence on the regression parameters. Inclusion of this facility would yield a much stronger quadratic effect (i.e., more rapidly decreasing marginal cost) that is not suggested by the other community hospitals in the data set. The estimated quadratic effect after excluding Womack ACH was mostly driven by the two largest Army hospitals remaining in the data set, Darnall ACH at Fort Hood, Texas, and Martin ACH at Fort Benning, Georgia. Because two years of data were combined, these two hospitals contributed a total of four data points to the regression model. However, the quadratic effect remained statistically significant, albeit somewhat smaller in magnitude, even after these four data points were removed (in an intermediate model not shown here).



Note: Expenses adjusted for other regression right-hand variables.

Figure V-7. Medical Center Inpatient Expenses Versus Workload (FY92 Dollars)



Note: Expenses adjusted for other regression right-hand variables.

Figure V-8. Community Hospital Inpatient Expenses Versus Workload (FY92 Dollars)

NH Newport was not a representative data point in FY92 because its observed expenses were nearly six standard deviations from the regression line. This aberration resulted because NH Newport began participating in an experimental civilian partnership program that distorted the relationship between reported cost and workload. Finally, several facilities did not report expenses, workload, or operating beds for a particular fiscal year, and were necessarily excluded from the model.

Figure V-9 is a scatterplot of the standardized residuals versus workload for the medical centers and community hospitals retained in the final inpatient model. Only those facilities that were included in the final model are shown in the figure, thereby indicating the goodness-of-fit of the regression line relative to the data from which it was estimated. The standardized residuals may be interpreted as normal scores so that, for example, 95.4% of the data points should fall within the range ±2.0 and 99.7% should fall within the range ±3.0. It is important to note that the variance of the residuals (i.e., the vertical dispersion) is basically constant throughout the range of possible workloads, so that the homoskedasticity requirement of regression theory is satisfied.

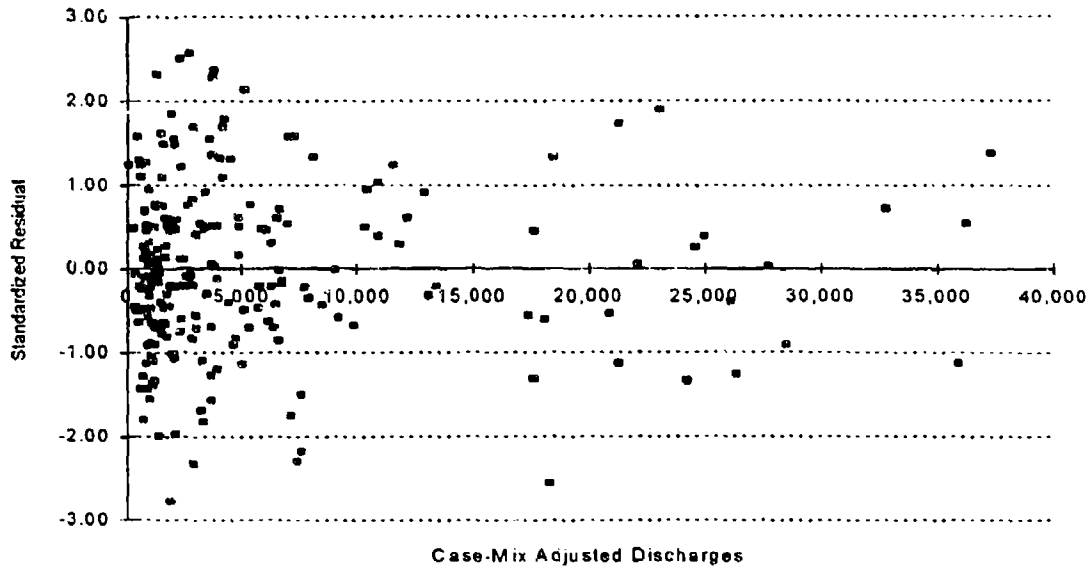


Figure V-9. Standardized Residuals Versus Inpatient Workload

A slightly different view of the data is obtained by plotting not the standardized residuals, but rather the percentage deviations between the observed inpatient expenses and the predicted inpatient expenses. Figure V-10 is a histogram of the percentage deviations, where positive values indicate that observed expenses exceed predicted expenses. Once again, only those facilities that were included in the regression are shown in the histogram. With the possible exception of the two endpoints, the histogram indicates a normal distribution of the percentage errors, implying that the statistical properties of the regression model are sound. In fact, the normal fit is understated in Figure V-10, because the two endpoints are open-ended intervals that result from collapsing the tails of the distribution into a single bar.

The relatively high mass at each endpoint (i.e., errors of 25% or more) indicates that we were conservative in discarding data points. These data points were retained, despite the large percentage errors, because they fell within three standard deviations of the regression line. As demonstrated in Figure V-8, the observed costs for a given level of workload vary substantially in the basic data. For example, the observed costs to produce 8,000 discharges, after adjusting for other independent variables, range between approximately $15 million and $27 million, an 80% spread. With this much spread in the basic data, a few data points will inevitably stray from the regression line.

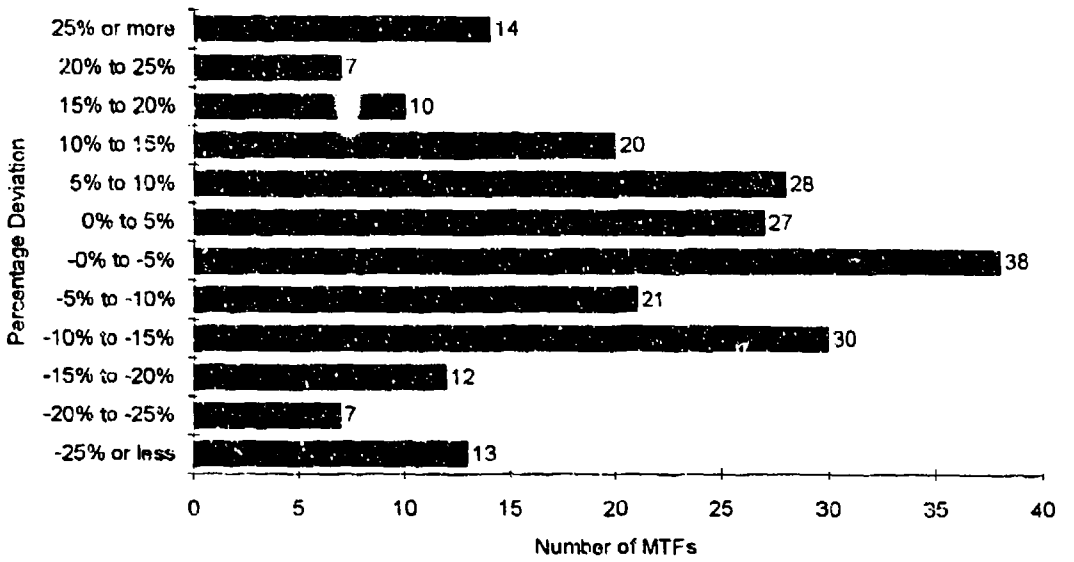


Figure V-10. Percentage Deviation Between Observed and Predicted Inpatient Expenses

Remember that the cost functions were not developed to estimate resource requirements for a particular facility. Rather, they were developed to estimate the change in system-wide costs as the aggregate level of workload is changed. The cost functions presented here are more than adequate for the task, and they predict hospital costs at least as well as most of their counterparts in the literature on civilian-hospital costs cited previously in Table V-2.

C. AMBULATORY COST FUNCTION

The ambulatory cost function was developed in a similar manner to the inpatient cost function. Because most ambulatory care in the civilian sector is not provided at hospitals, there was little basis for comparison between the civilian and military sectors in this case. No obvious measure of ambulatory capacity parallels our previous use of operating beds in modeling inpatient costs. Nor is there any system comparable to DRG weights to enable an adjustment for relative resource-intensity. Before turning to the regression estimates, we must discuss the workload exchange rates. These rates were developed for the Section 733 Study to reflect the differences between medical workload as reported in the accounting systems and medical workload as self-reported by medical beneficiaries.

1. Workload Exchange Rates

The RAND Corporation used data from the 1992 DoD Health Care Survey[6] to calibrate its models that forecast utilization under analytical cases. RAND then provided IDA with inpatient and ambulatory workload estimates for each analytical case. However, the amount of medical workload differs, often dramatically, between MEPRS and the beneficiary survey. Thus, the hypothetical workloads are measured along one scale, but the IDA cost functions require workload measured along a different scale. A conversion is clearly necessary to make the RAND workload numbers "fit" into the IDA cost functions.

To circumvent this problem, RAND has computed a set of "exchange rates," which play a role analogous to the rates used in converting two currencies (e.g., dollars to yen). RAND has computed the exchange rates along various dimensions (e.g., inpatient versus outpatient care, beneficiary category, and Service branch).[7] As an example, Figure V-11 shows the exchange rates, by Service branch, for ambulatory visits. The figure reveals that more workload is reported in MEPRS than in the beneficiary survey, but the difference is less pronounced for the Navy than for the other two Services.

A critical assumption is being made when using the exchange rates to "fit" hypothetical workload numbers into the IDA cost functions. Specifically, it is being assumed that the historical relationships between the two measurement systems will be maintained under the analytical cases. For example, suppose that the beneficiary survey initially shows 100 visits to Air Force hospitals, whereas MEPRS data show 160 visits (reflecting the Air Force exchange rate of 1.6). If survey-based analysis predicts a 10% increase to 110 visits, then the new workload figure for the MEPRS-based cost function also increases by 10%, to 176 visits. As long as the exchange rate remains constant at 1.6 under the analytical case, this procedure is valid. The procedure would fail only if some feature of the analytical case drove a wedge between the incentives to report workload

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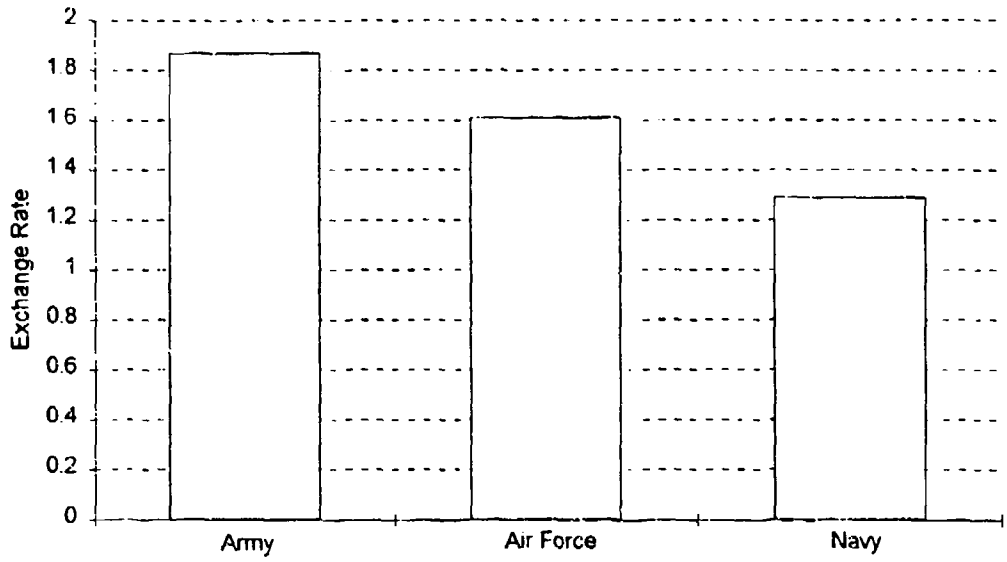
6 The survey design and findings are documented in Philip M. Lurie, Karen W. Tyson, Michael L. Fineberg, Larry A. Waisanen, James A. Lee, James A. Roberts, Mark E. Sieffert, and Bette S. Mahoney, "Analysis of the 1992 DoD Survey of Military Medical Care Beneficiaries," Institute for Defense Analyses, Paper P-2937, January 1994.

7 The complete set of exchange rates is available in Susan D. Hosek, Bruce W. Bennett, Joan Buchanan, M. Susan Marquis, Kimberly A. McGuigan, Jan M. Hanley, Roger Madison, Afshin Rastegar, and Jennifer Hawes-Dawson, "The Demand for Military Health Care: Supporting Research for a Comprehensive Study of the Military Health Care System," RAND Corporation, MR-407-1-OSD, September 1994.

under the two systems. Although we are not aware of any such feature, the calculation and use of exchange rates between data systems requires additional research.



Note: Exchange rate = FY92 ambulatory visits reported in MEPRS, divided by ambulatory visits estimated from the beneficiary survey.

Figure V-11. Ambulatory-Workload Exchange Rates, by Service Branch

2. Preliminary Data Analysis

Figure V-12 shows the variation, across MTFs, in the percentage change in average outpatient cost that occurred between FY90 and FY92. These are again two-year *cumulative* percentage changes, where the FY90 costs were escalated to FY92 dollars before computing the percentage change. At the extremes, some thirteen MTFs showed an increase of over 25%, while nine MTFs showed a decrease of over 25%. These large changes illustrate the difficulty in developing a model to predict the level of cost at a given facility.

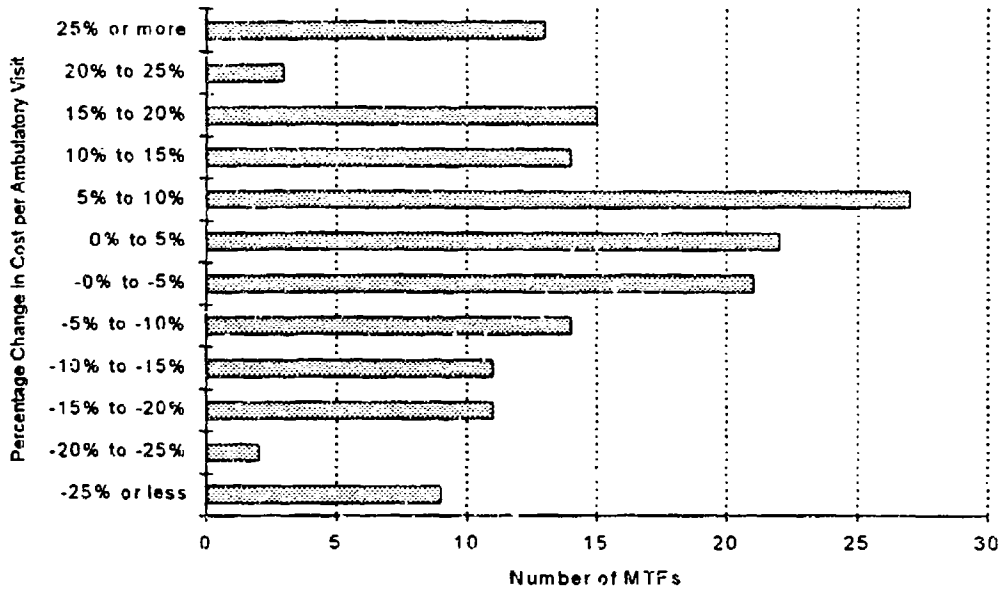


Figure V-12. Histogram of Percentage Change in Cost per Ambulatory Visit, FY90 to FY92 (Measured in FY92 Dollars)

Figures V-13 through V-15 highlight the variation in the *level* of cost per ambulatory visit, rather than the rate of growth. Again, both FY90 and FY92 costs are expressed in FY92 dollars. There is wide variation in average cost within each of the facility types. Some 67% of the medical centers and 82% of the community hospitals had average costs between $70 and $110 during FY92. By constrast, 59% of the clinics had average costs in the slightly lower range between $60 and $100. The lower average costs for clinics may be due to their smaller overhead. However, we will show presently that the *marginal* costs are higher in clinics than in medical centers and most community hospitals.

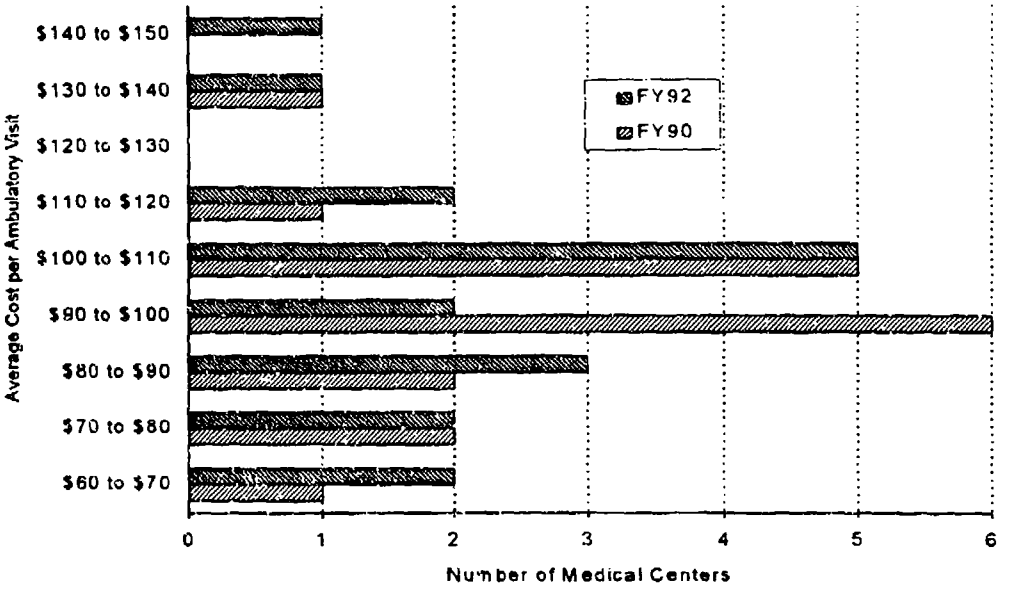


Figure V-13. Histogram of Average Medical Center Cost per Ambulatory Visit (FY92 Dollars)

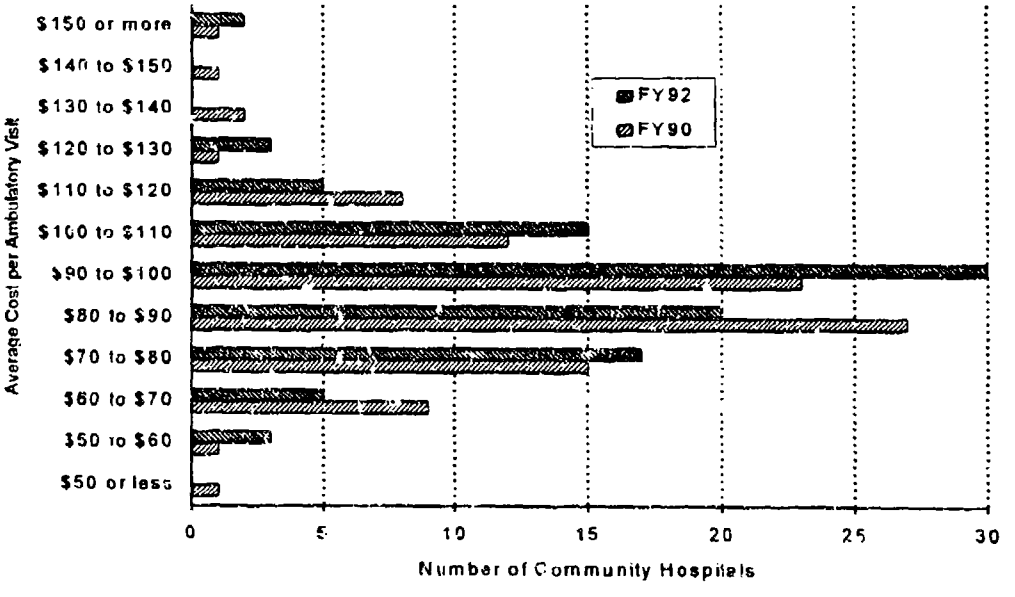


Figure V-14. Histogram of Average Community Hospital Cost per Ambulatory Visit (FY92 Dollars)

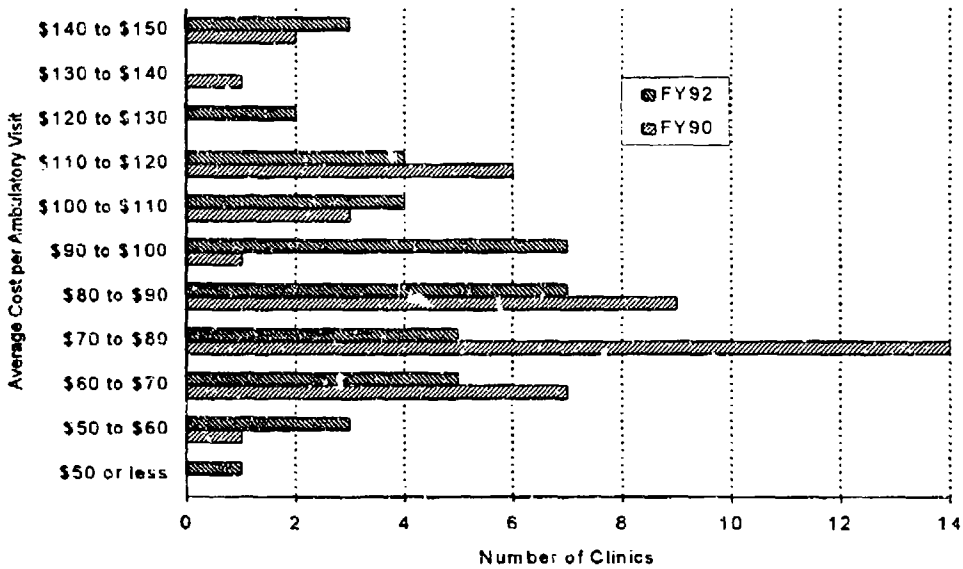


Figure V-15. Histogram of Average Clinic Cost per Ambulatory Visit (FY92 Dollars)

3. Regression Estimates

The ambulatory cost function was estimated using expenses reported in the MEPRS B (Ambulatory) accounts. The MEPRS adjustment factors, derived in Chapter III, were applied to both the FY90 and FY92 MEPRS expense data. Then the escalation rates were applied only to the FY90 expenses, in order to express them in FY92 dollars. The ambulatory regression data appear in Appendix E.

Figure V-16 displays the relationship between ambulatory expenses (FY90 and FY92 data measured in FY92 dollars) and the number of visits, with symbols identifying the facilities by type. Again, we see different cost structures for different classes of facilities. Total costs are generally highest at medical centers, even in the wide region of overlap with community hospitals. One immediate outlier is NNMC Bethesda in FY92, which displays an adjusted ambulatory cost of nearly $120 million for roughly 600,000 visits. The scatter for community hospitals again indicates decreasing marginal costs. These phenomena were modeled using facility-type dummy variables, plus a quadratic term for the community hospitals only.

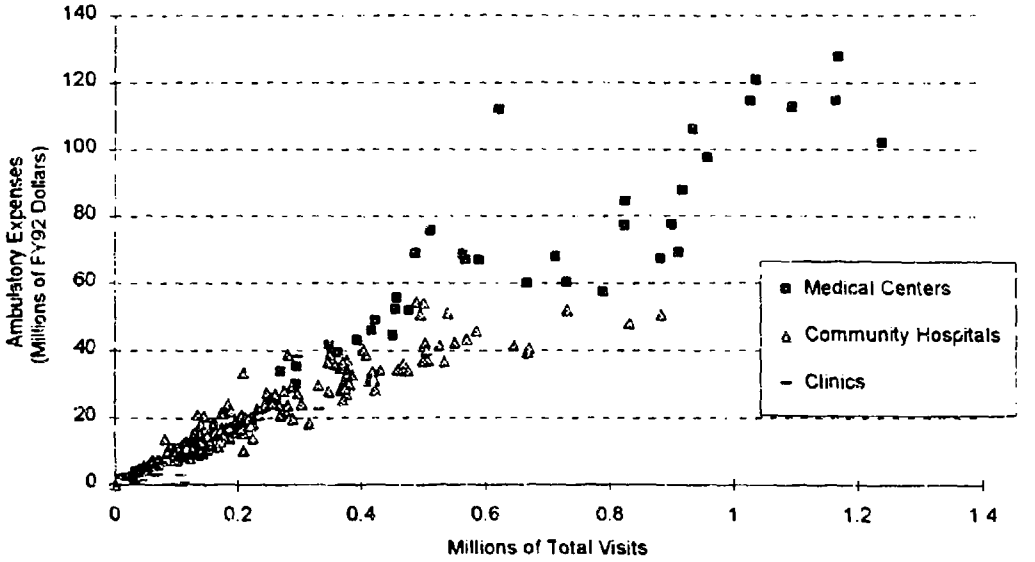


Figure V-16. FY90 and FY92 Ambulatory Expenses (FY92 Dollars), by Facility Type

The data include a total of 35 observations over the two years on clinics outside the continental United States (OCONUS). As is shown later, inclusion of the OCONUS clinics had virtually no effect on the coefficient estimates, but did improve their precision by increasing the sample size. Finally, as previously discussed for the inpatient model, there is large variation in observed expenses for a given level of workload. For example, facilities operating at roughly 900,000 visits per year report expenses ranging between approximately $50 million and $110 million, a 120% spread.

Figure V-17 visually demonstrates that the FY90 data points are again interspersed well with the FY92 data points after application of the escalation rates. Statistical tests indicated that the separate regression relationships for the two years were indistinguishable, thereby justifying our decision to combine them into a single cost function.

The sample composition and data exclusions are shown in Table V-6.

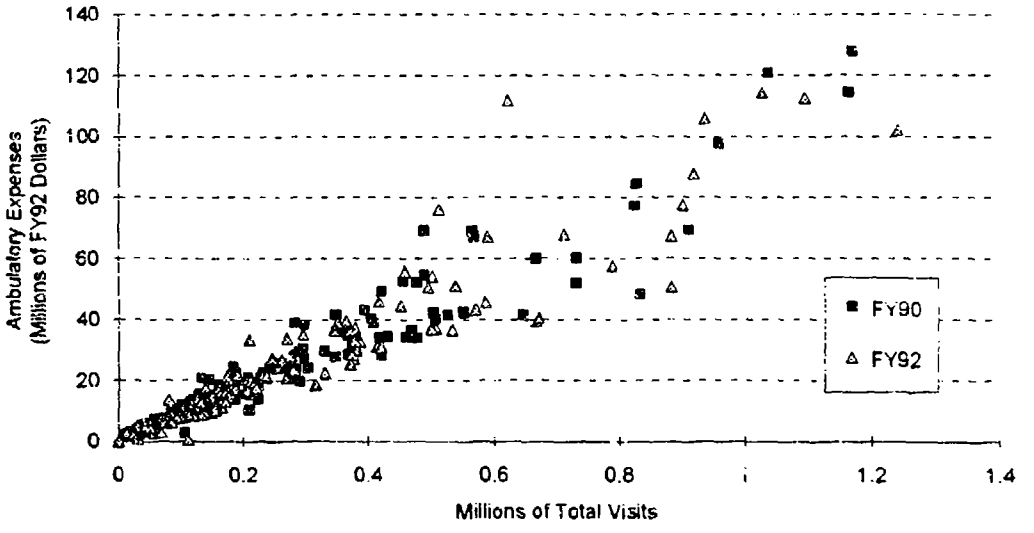


Figure V-17. FY90 and FY92 Ambulatory Expenses (FY92 Dollars), by Fiscal Year

Table V-6. Sample Size for Ambulatory Cost Model

Facility Type	FY90	FY92	Total
Medical Centers	18	13	31
Community Hospitals	101	96	197
CONUS Clinics	27	26	53
OCONUS Clinics	18	17	35
Total	164	152	316

The following data points were removed from the model prior to estimation:

Facility Name	Fiscal Year	Reason
NH Oakland	FY90, FY92	High Leverage
NH Portsmouth	FY90, FY92	High Leverage
NH San Diego	FY90, FY92	High Leverage
Letterman	FY92	Structural
Walter Reed	FY90	High Leverage
509th Strategic Hospital	FY92	Missing Data
7020th ABG Clinic	FY92	Missing Data
Air University	FY90	Outlier
NH Long Beach	FY90, FY92	Outlier
Port Hueneme	FY90, FY92	Outlier
Bethesda	FY92	Outlier
NH Patuxent River	FY92	Outlier
Kimbrough AH	FY92	Outlier
NH Corpus Christi	FY92	Outlier
Pearl Harbor	FY90	Outlier

The ambulatory cost-function parameter estimates and summary statistics are presented in Table V-7. The regression function is linear for medical centers and clinics, but includes a quadratic effect (i.e., decreasing marginal costs) for community hospitals.

Table V-7. Final Ambulatory Model

Model Functional Form:
Ambulatory Expenses = (Intercept + Community Hospital Intercept Adjustment + Clinic Intercept Adjustment + B1*Total Visits + B2*Community Hospital Total Visits + B3*Clinic Total Visits + B4*Community Hospital Total Visits Squared + B5*GME) * (1 + B6*NAVY)

Variables	Mean Value	Coefficient Estimate	t-Statistic	95% Confidence Interval	
Intercept		19,814,482	5.146	12,113,576	27,515,388
Community Hospital Intercept Adjustment		-19,919,506	-5.147	-27,659,104	-12,179,908
Clinic Intercept Adjustment		-18,633,084	-4.834	-26,342,532	-10,923,636
Total Visits	217,676	42	4.370	23	61
Community Hospital Total Visits	144,141	+58	5.583	38	79
Clinic Total Visits	17,769	+27	2.634	7	47
Community Hospital Total Visits Squared	4.87e+10	-0.0000527	-7.927	-.0000658	-.0000396
GME (Residents & Interns)	16	102,915	5.281	64,564	141,266
Navy Adjustment		12.41%	5.475	7.95%	16.87%

Notes: R-squared = 0.9811, adjusted R-squared = 0.9805, standard error of regression = $1.43M.

The coefficients are interpreted in the following manner:

- Intercept: The cost that would be predicted at a medical center if all regression variables were set to zero. Because medical centers are never observed in this situation, the confidence interval is extremely wide; the estimate involves extrapolation well outside the range of observed data.
- Community Hospital Intercept Adjustment: The difference between the medical-center intercept and community-hospital intercept. The net result is an intercept that is negative but not significantly different from zero at the 95% confidence level.
- Clinic Intercept Adjustment: The difference between the medical-center intercept and clinic intercept. The net result is an intercept of approximately $1.2 million, which is significantly different from zero at the 95% confidence level.
- Total Visits: The marginal cost of producing an additional visit at a medical center.

- Community Hospital Total Visits: The difference between the marginal cost of producing an additional visit at a community hospital, versus the marginal cost of producing an additional visit at a medical center, *prior* to adjusting for the diminishing marginal costs identified at the former. Thus, the marginal cost of the first visit at a community hospital equals $42 plus $58, or $100.
- Community Hospital Total Visits Squared: The square of the visits is used as an independent variable to identify potential increasing or decreasing marginal costs with increases in workload. The negative coefficient implies that marginal costs decrease with an increase in workload (i.e., economies of scale).
- Clinic Total Visits: The difference between the marginal cost of producing an additional visit at a clinic, versus the marginal cost of producing an additional visit at a medical center. Because there is no evidence of economies of scale for clinics, the marginal cost of a visit is $42 plus $27, or $69, for all levels of clinic workload.[8]
- GME (Residents and Interns): An estimate of the additional *patient-care* cost incurred by providing graduate medical education, measured in terms of cost per enrolled resident or intern. This estimate reflects student salaries charged directly to the MEPRS B (Ambulatory) account. It also reflects classroom time factored into total expenses via the FAK-account (Student Expenses) adjustment, as described in Chapter III, so as to include all student salaries. Recall, however, that the FAK accounts were spread as system-wide overhead, rather than being assigned directly (and exclusively) to teaching facilities.
- Navy Adjustment: Due to structural and accounting differences, it was necessary to include a variable to distinguish Navy facilities from Army and Air Force facilities.

As previously discussed, the Navy adjustment should *not* be interpreted as evidence that Navy hospitals are more expensive or less efficient than Army or Air Force hospitals. The Navy exchange rate in Figure V-11 is 20% lower than the Air Force rate, and 31% lower than the Army rate. The Navy's apparent conservatism in recording MEPRS workload could easily explain the 12.4% difference in unit cost identified in the regression

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[8] To determine whether CONUS and OCONUS clinics have the same cost structure, we reestimated the regression after deleting the OCONUS clinics. The result was a marginal cost of $73. The estimate of $69 reported in the text is more precise (i.e., has a smaller standard error), because it is based on more observations. For this reason, and because the two estimates are so close, we view $69 as our best estimate of the marginal cost for clinics.

analysis. However, further research is clearly warranted to improve the comparability of cost and workload data across the three Services.

Ambulatory marginal costs are constant with respect to workload for medical centers and clinics, but decrease over the range of data for community hospitals. The model estimates of marginal cost are depicted in Figure V-18. Marginal costs for community hospitals fall to zero at a level of approximately 950,000 total visits, which is nearly 70,000 more than the highest observed value for community hospitals. The marginal cost for medical centers equals the marginal cost for community hospitals at a level of roughly 554,000 total visits; only five community hospitals operate at this level or greater. The marginal cost for clinics equals the marginal cost for community hospitals at a level of approximately 300,000 visits; about one-quarter of all community hospitals operate at this level or greater.

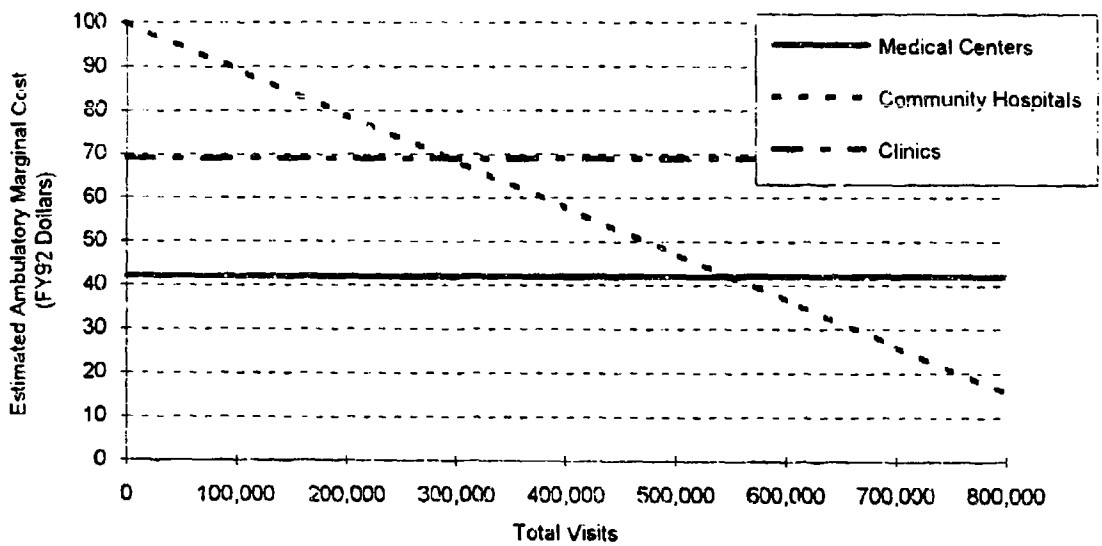

Figure V-18. Ambulatory Marginal Cost Versus Workload, by Facility Type

The estimates of patient-care costs associated with GME in the inpatient and ambulatory cost functions are additive. That is, for each resident or intern enrolled in an average teaching facility's GME program, the increase in patient-care cost is estimated as $65,862 for inpatient care plus $102,915 for ambulatory care. Thus, the total addition to patient-care cost at the average teaching facility is estimated as $168,777 per resident and intern. This estimate is clearly too high to represent simply the salaries of the medical

students. It represents, more generally, the different approach to medical care that is pursued at teaching hospitals.[9]

It is difficult to compare the estimate for ambulatory care with the civilian sector, because ambulatory care in the civilian sector is generally not provided at hospitals. Regarding inpatient care, recall that we measure GME by the headcount of enrolled residents and interns, whereas the Health Care Financing Administration (HCFA) divides the headcount by the number of staffed beds in computing its hospital reimbursement factor. We experimented with some inpatient cost models in which we divided the headcount by reported operating beds, recognizing that operating beds are an imperfect measure of capacity. We found coefficients on this variable quite similar to those used in the HCFA reimbursement formula.[10] However, more research is needed to assess the efficiency with which military hospitals provide GME.

Figures V-19 through V-21 display the relationships between total ambulatory expenses and workload, for each facility type, after adjusting for the effects of GME and Service branch. Recall from Table V-6 that several data points were excluded from the model as outliers, highly leveraged data points, or facilities with missing data. Data points excluded from the regression are indicated by triangular symbols; the most extreme such data points are also identified by facility name. Again, FY92 data for Letterman AMC were removed because operations were curtailed in preparation for closing. All data points identified as outliers have observed expenses more than three standard deviations from the regression line.

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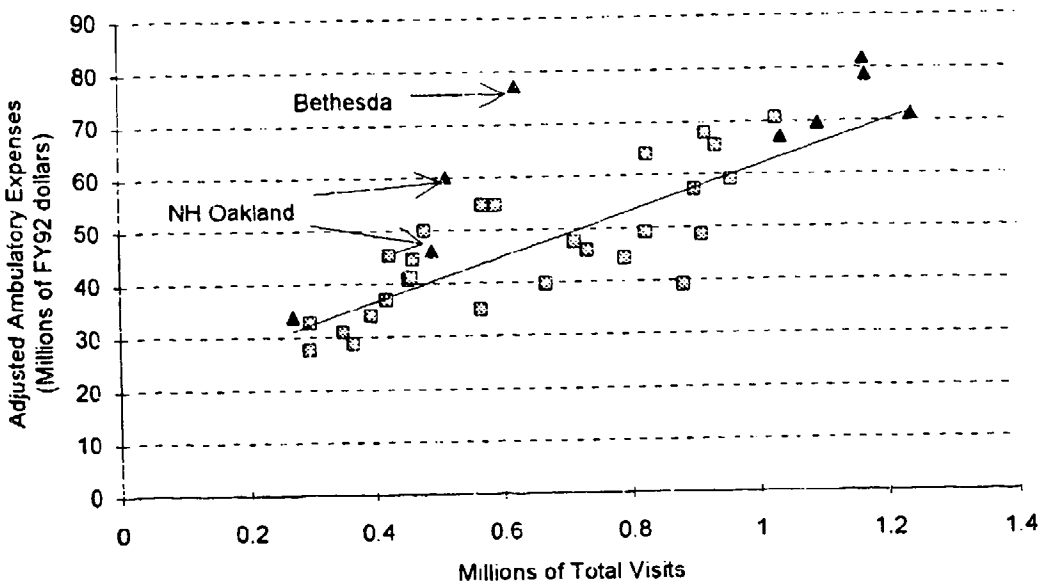
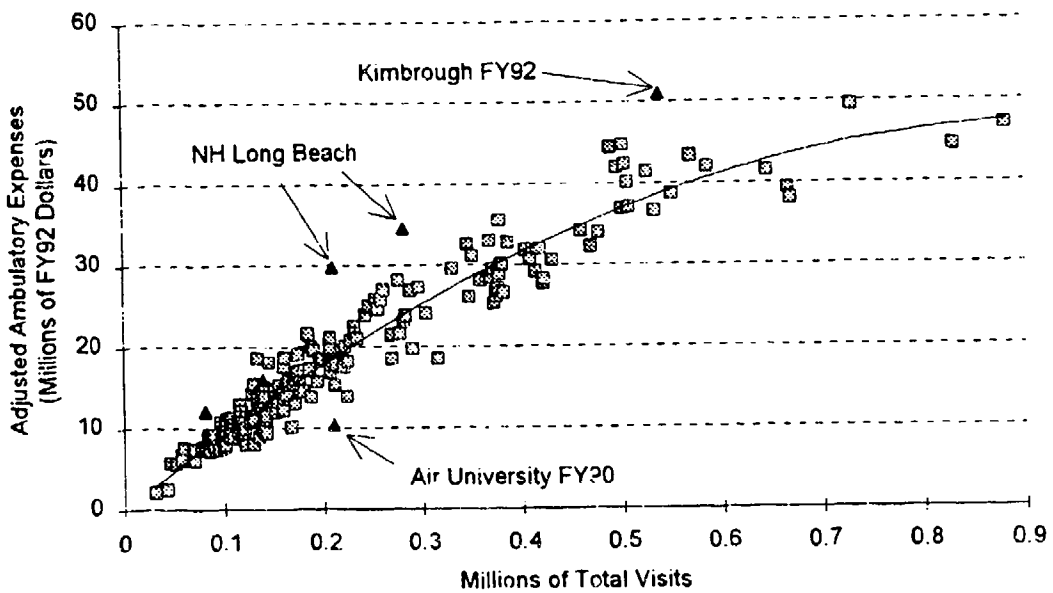
9 One important component of the difference is shown in the EBE (Graduate Medical Education Support) and EBF (Education and Training Program Support) accounts of MEPRS. As indicated in Chapter III, these two accounts are stepped-down to the inpatient and ambulatory accounts, and are thereby reflected in our regression equations. These accounts record expenses accrued primarily at teaching hospitals (e.g., instructor salaries, medical library, medical illustration, and medical photography).

10 Health Care Financing Administration (HCFA). *Federal Register*, Vol. 52, No. 169, September 1, 1987.



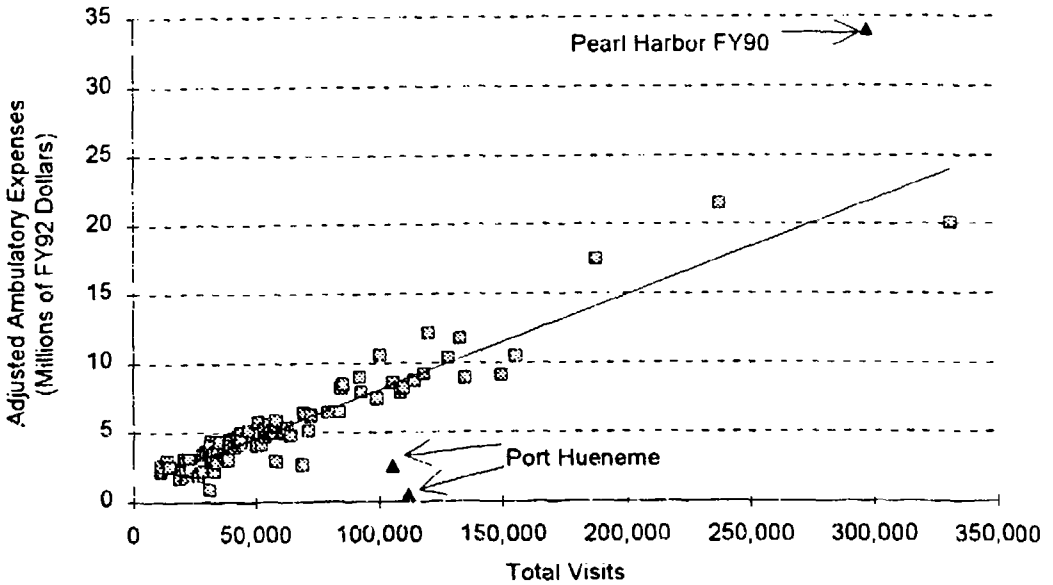
Note: Expenses adjusted for other regression right-hand variables.

Figure V-19. Medical Center Ambulatory Expenses Versus Workload (FY92 Dollars)



Note: Expenses adjusted for other regression right-hand variables.

Figure V-20. Community Hospital Ambulatory Expenses Versus Workload (FY92 Dollars)



Note: Expenses adjusted for other regression right-hand variables.

Figure V-21. Clinic Ambulatory Expenses Versus Workload (FY92 Dollars)

Seven data points were removed due to having high leverage. These data points have undue influence on one or more of the regression parameters. A two-dimensional scatterplot of costs versus workload may show these data points near the regression line. However, a scatterplot of costs versus number of residents and interns, after adjusting for workload, may show that a particular facility has undue influence on the GME coefficient, perhaps because its GME program is substantially larger than those at most other facilities. The method used to identify highly leveraged data points considers each independent variable in turn, and compares the value of that variable for each facility relative to the mean across all facilities. The influence on the regression model as a whole is then considered to determine whether or not each point is highly leveraged.[11] The data points excluded, primarily a few of the Navy medical centers, typically caused substantial changes in the Navy adjustment, the GME coefficient, or the marginal cost of a medical-center visit. Based on analysis of the alternative models generated when including or excluding these data points, it was determined that the model selected here best represents the data set as a whole.

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[11] See D. A. Belsley, E. Kuh, and R. E. Welsch, *Regression Diagnostics*, New York: Wiley, 1980; or R. D. Cook and S. Weisberg, *Residuals and Influence in Regression*, London: Chapman Hall, 1982.

Figure V-22 is a scatterplot of the standardized residuals versus workload for the medical centers, community hospitals, and clinics retained in the final ambulatory model. Only those facilities that were included in the final model are shown in the figure. As was the case for the inpatient model, the variance of the residuals is basically constant throughout the range of possible workloads, so that the homoskedasticity requirement of regression theory is satisfied.

Figure V-23 is a histogram of the percentage deviations between the observed ambulatory expenses and the predicted ambulatory expenses. Positive values again indicate that observed expenses exceed predicted expenses. Only those facilities used in the regression analysis are included in this histogram. The histogram indicates a normal distribution of percentage deviations from the regression line. As before, the normal fit is understated in Figure V-23, because the two endpoints are open-ended intervals that result from collapsing the tails of the distribution into a single bar.

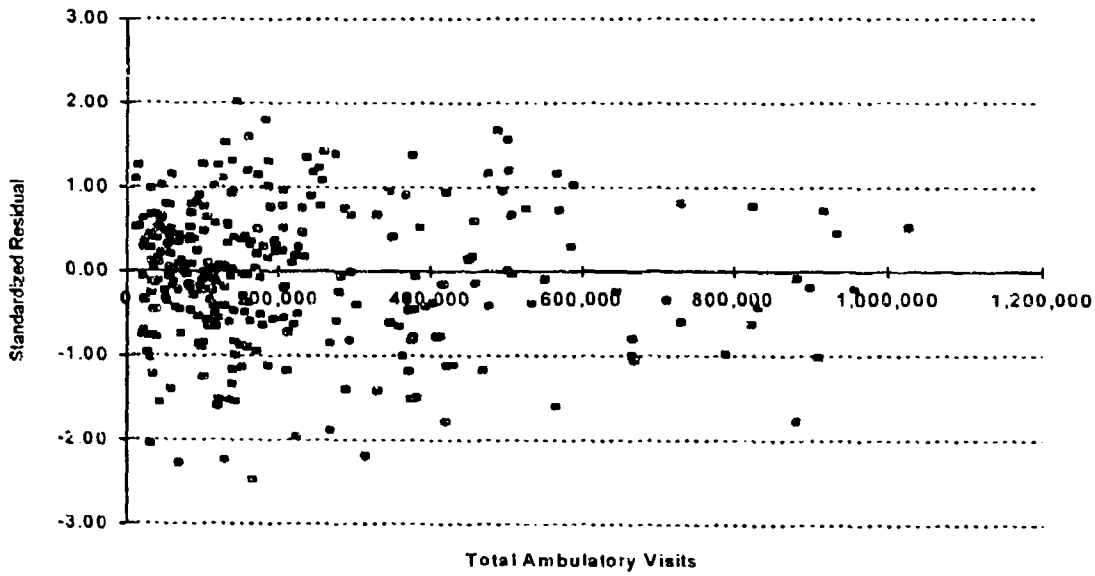

Figure V-22. Standardized Residuals Versus Ambulatory Workload

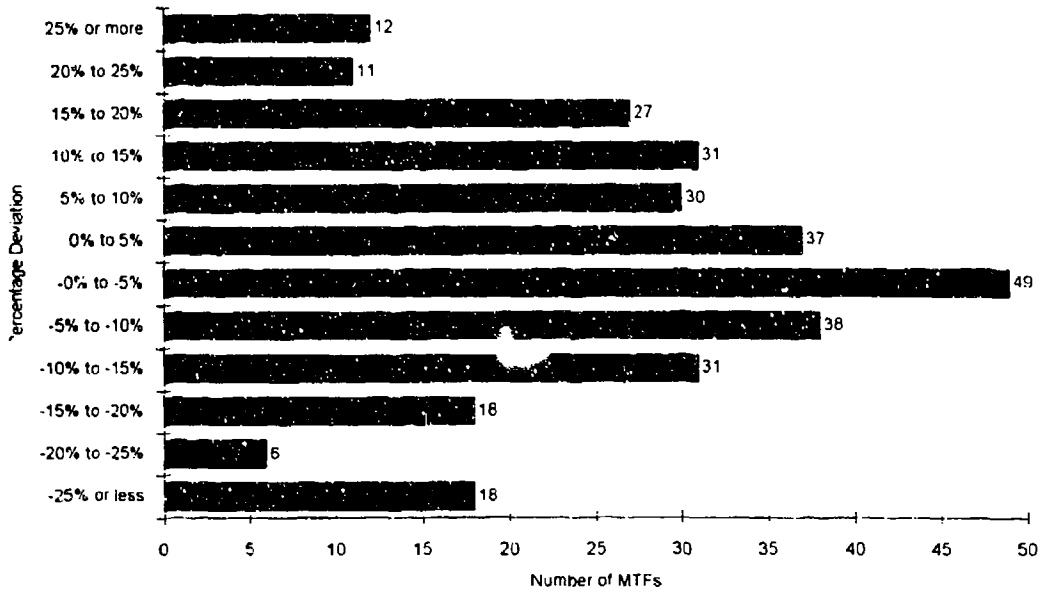

Figure V-23. Percentage Deviation Between Observed and Predicted Ambulatory Expenses

Several additional independent variables were considered in an attempt to improve the model fit, including geographic variation in labor or total costs, economies or diseconomies of scope (i.e., facilities that offer a greater variety of services experience lower or higher marginal costs), and demographics of the patient population served. However, none of these variables were significant in reducing the error in our models.

D. SUMMARY OF MTF COST FUNCTIONS

The inpatient and ambulatory cost functions just described will be used in the next chapter to cost the hypothetical workloads corresponding to the analytical cases. The RAND Corporation conducted the utilization analysis of each analytical case. RAND provided IDA with inpatient and ambulatory workload estimates for each analytical case, as well as any changes to operating-bed capacity or the volume of GME. Prior to delivering the workloads to IDA, RAND applied the appropriate exchange rates. Once again, these exchange rates are valid only if the historical relationships will be maintained between workload as reported in the accounting systems and workload as self-reported in the survey data. Because the link between survey-based utilization and the accounting data is critical for making cost-effectiveness comparisons, the exchange rates clearly warrant further research.

VI. COST ESTIMATES FOR THE ANALYTICAL CASES

This chapter contains the estimates of military treatment facility (MTF) cost for the estimated workloads corresponding to the various analytical cases. Case 1 is a minor excursion from historical FY92 data, reflecting managed-care initiatives that had not yet been fully implemented during that year. Non-active-duty beneficiaries would continue to have a choice between care provided at MTFs and care provided in the civilian sector under CHAMPUS. However, a preferred-provider feature is assumed to be available that offers discounts for care received from civilian providers on a specified list. Case 2 goes beyond Case 1 by constructing new MTFs and expanding several existing MTFs. These changes would occur only in cases where the beneficiary population in the catchment-area could support the additional beds.

Before presenting the detailed cost estimates, we motivate the first two cases by developing a decomposition of the total change in cost into efficiency and demand effects. This decomposition addresses the issue of whether or not total (i.e., MTF plus CHAMPUS) workload is held constant when evaluating the net change in cost. Next, we give a summary description of the first two cases in terms of changes in the inpatient and ambulatory workloads at MTFs and changes in operating-bed capacity. We then present the detailed estimates of MTF cost for these two cases. Finally, we discuss "below the line" cost elements that are not explicitly modeled by either IDA or RAND, but that must be added to the IDA and RAND figures to round-out the estimate of total peacetime medical expenditure under these two cases.

The third and fourth analytical cases represent wider departures from the current system. The third case is the "Minimal-MTF Case," which shifts as many beneficiaries as possible to civilian health care, while maintaining the military's capability to treat wartime casualties. The fourth case involves "Single-Plan Enrollment," so that non-active-duty beneficiaries enroll in a single medical plan, and receive all of their care exclusively from that plan. MTFs would be reconfigured as Health Maintenance Organizations (HMOs), responsible for providing all required care to their enrollees either through their own staffs or through civilian sub-contracts. Other enrollment options might include Fee-for-Service (FFS) plans and Preferred-Provider Organizations (PPOs). Beneficiaries who select either

of those options would forfeit any eligibility for care at MTFs. Finally, active-duty personnel would continue to receive care at MTFs or at the outlying military clinics. Both the third and fourth cases involve not just changes in workload and operating-bed capacity, but also fundamental changes in the way that military health care is organized and delivered. These cases are described in considerable detail before the respective cost estimates are presented.

Complete descriptions of the analytical cases, as well as projections of MTF workload and civilian-sector cost for each case, are found in a RAND Corporation publication.[1] This chapter contains the IDA projections of MTF cost under each case. An overall assessment of the cost-effectiveness of each case requires integration of the IDA and RAND cost projections, as well as consideration of third-party collections and beneficiary deductibles and co-payments. These overall assessments were performed by the Office of the Director (Program Analysis and Evaluation), and appear in that office's executive report.[2]

A. ANALYTICAL CASES 1 AND 2

1. Decomposition of Efficiency and Demand Effects

A major objective of the 733 Study is to determine whether it is more cost-effective to expand MTF capacity and move workload in-house or, conversely, to reduce MTF capacity and move workload into CHAMPUS. This question can be answered by combining IDA's cost functions for in-house medical care with the CHAMPUS cost estimates developed by RAND. This section provides a framework for analyzing the transfer of workload from CHAMPUS into the MTFs. The numerical examples in this section are purely illustrative, and do not reflect actual cost estimates.

An important concept in performing this analysis is the *recapture rate*. Suppose that MTF capacity is increased, yielding 100 additional MTF visits. If the number of CHAMPUS visits decreases by exactly 100, then the recapture rate is 1.0. However, it is

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1 Susan D. Hosek, Bruce W. Bennett, Joan Buchanan, M. Susan Marquis, Kimberly A. McGuigan, Jan M. Hanley, Roger Madison, Afshin Rastegar, and Jennifer Hawes-Dawson, "The Demand for Military Health Care: Supporting Research for a Comprehensive Study of the Military Health Care System," RAND Corporation, MR-407-1-OSD, September 1994.

2 "The Economics of Sizing the Military Medical Establishment: Executive Report of the Comprehensive Study of the Military Health Care System," Department of Defense, Office of the Director (Program Analysis and Evaluation), March 1994.

likely that the increase in MTF visits will exceed the reduction in CHAMPUS visits. Co-payments are zero for outpatient care provided in MTFs, but range between 20% and 25% for outpatient care provided under CHAMPUS. Given the availability of more *free* care, 100 MTF visits might replace 80 CHAMPUS visits. The recapture rate is defined as the ratio of the increase in MTF visits, divided by the decrease in CHAMPUS visits.

When access to MTF care is increased, it is useful to analytically partition the change in total cost into an efficiency effect and a demand effect. The efficiency effect is defined as the change in total (MTF plus CHAMPUS) cost when the recapture rate is set to 1.0. Workload is held constant in this comparison, and the only issue is whether a given increment in workload can be produced at higher or lower cost in MTFs versus CHAMPUS. Next, the recapture rate is relaxed to a larger value, more consistent with empirical experience. Because demand increases, costs will increase beyond the level estimated for a unitary recapture rate. However, this latter increase does not reflect an efficiency comparison, because total workload is no longer held constant.

These principles will now be illustrated in a series of numerical examples.

a. Equal Marginal Costs

In the first example, the two sectors have equal marginal costs of $10 per visit. However, the cost functions in Figure VI-1 have been drawn such that the intercept is higher by $100 in MTFs.

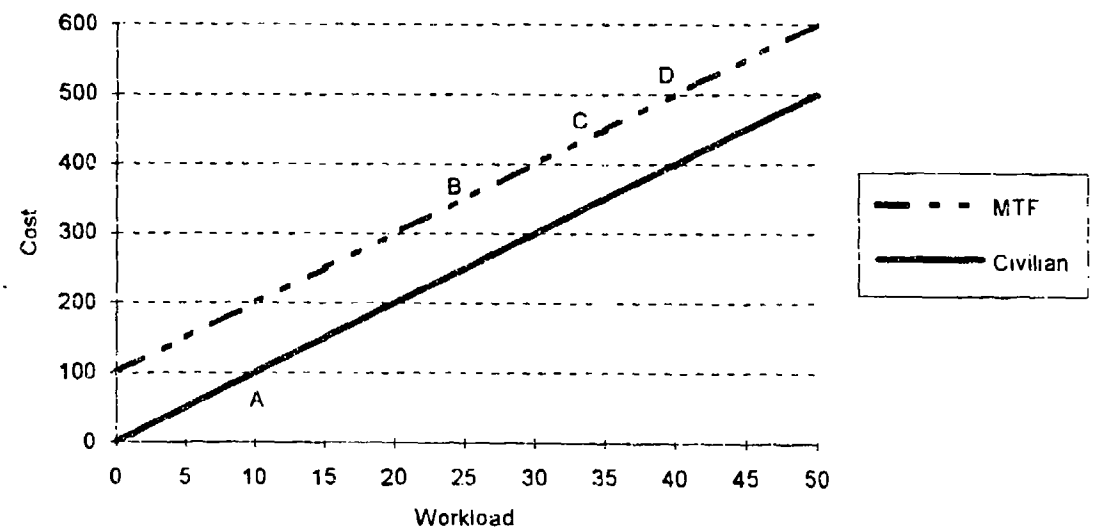

Figure VI-1. Cost and Workload: Equal Marginal Costs

Suppose Scenario 1 has workloads of 10 visits to civilian p. /sicians under CHAMPUS, and 25 visits to MTFs. The respective costs are $100 and $3[illegible] (points A and B in Figure IV-1). Scenario 2 moves workload from CHAMPUS back into the MTFs. We decompose the total movement into two effects. First, we fix the recapture rate at exactly 1.0. Thus, the 10 CHAMPUS visits are replaced by *exactly* 10 MTF visits. The new total of 35 MTF visits costs $450 (point C). Total cost does not change, because the marginal cost of reduced CHAMPUS workload equals the marginal cost of increased MTF workload.

Now introduce a recapture rate $\Theta = 1.5$. The 10 CHAMPUS visits are now replaced with 15 MTF visits, and total cost increases to $500 (point D). The efficiency effect for this example is $0, but the demand effect is $50. These effects are recorded in Table VI-1.

Table VI-1. Efficiency and Demand Effects for Hypothetical Examples

	Description	Efficiency Effect	Demand Effect
E: ample 1	Equal marginal costs	$0	$50
Ex.mple 2	Unequal marginal costs	$20	$60
Example 3	Diminishing marginal costs	$10	$48

b. Unequal Marginal Costs

In the second example, the intercept is still higher by $100 in MTFs. In addition, the marginal cost per visit in MTFs is now higher as well, $12 versus $10. These values are reflected in the two cost curves shown in Figure VI-2.

Scenario 1 still has workloads of 10 visits to civilian physicians under CHAMPUS, and 25 visits to MTFs. The respective costs are $100 and now $400 (points A and B). Scenario 2 moves workload from CHAMPUS back into the MTFs. We again decompose the total movement into two effects. First, we fix the recapture rate at exactly 1.0. Thus, the 10 CHAMPUS visits are replaced by *exactly* 10 MTF visits. The new total of 35 MTF visits costs $520 (point C). Total cost has increased by $20, because the 10 marginal units are being performed at a higher marginal cost ($12 versus $10 each).

Now introduce a recapture rate $\Theta = 1.5$. The 10 CHAMPUS visits are now replaced with 15 MTF visits, and total cost increases further to $580 (point D). The

efficiency effect for this example is $20, but the demand effect is $60, as shown in Table VI-1.

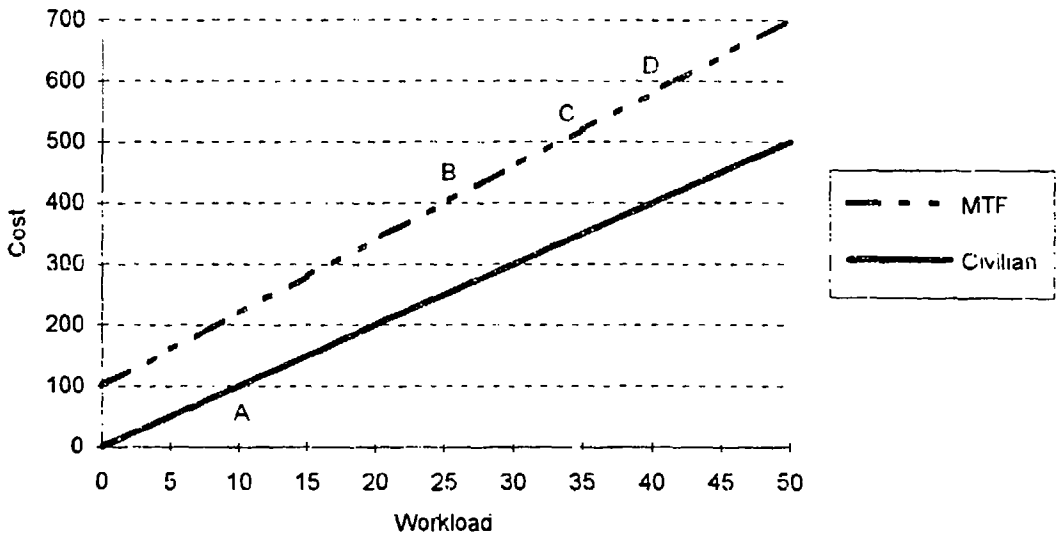

Figure VI-2. Cost and Workload: Unequal Marginal Costs

c. Diminishing Marginal Costs

In our final example, we introduce a quadratic term into the MTF cost function, to represent diminishing marginal costs (i.e., increasing returns).[3] Thus, the MTF cost function is drawn as concave to the origin in Figure VI-3. MTF costs equal $400 at 25 visits (point B) but, because of the non-linearity, they equal only $510 at 35 visits (point C). Marginal cost declines continuously from $12 to $10 over this range. Total cost equals $558 at 40 visits (point D), the workload resulting from application of the recapture rate, $\Theta = 1.5$.

The analyst must be cautioned against extrapolating MTF costs along the tangent line, which has a fixed slope of $12 (i.e., the marginal cost at the baseline workload of 25 visits). The marginal cost is diminishing in this example, so that linear extrapolation (i.e., treating the marginal cost as though it were constant) would lead to an over-estimate of

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[3] The cost function for this example is: $C = 37.57 + 17.0X - .10\ X^2$. Quadratic functions of this form are reported in Chapter V, although the coefficients in this example are purely illustrative.

MTF costs. By linearly extrapolating, we would over-estimate MTF costs at $520 (point E) for a recapture rate of $\Theta = 1.0$, and at $580 (point F) for a recapture rate of $\Theta = 1.5$.

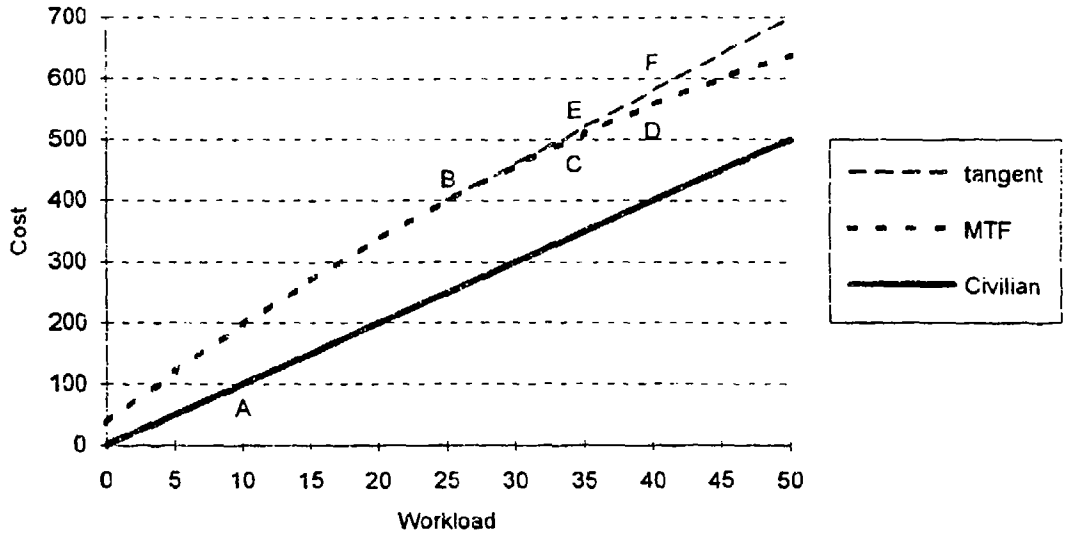
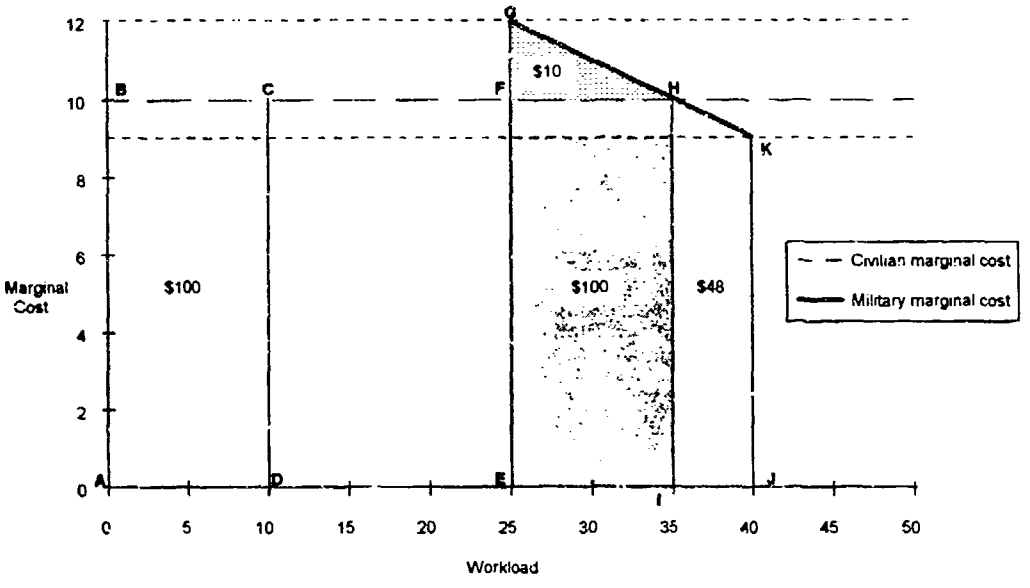


Figure VI-3. Cost and Workload: Diminishing Marginal Costs

d. Efficiency and Demand Effects

It is illuminating to analyze the previous example of diminishing marginal costs by using marginal rather than total cost curves. The marginal cost curve for visits to civilian physicians (curve BCFH in Figure VI-4) is horizontal at $10, reflecting perfectly elastic supply in a competitive medical market. Over the range of interest, the marginal cost curve for visits to MTFs (curve GHK) declines continuously from $12 at 25 visits, to $10 at 35 visits, to $9 at 40 visits.

Consider first the transfer of 10 visits from civilian physicians to MTFs, which occurs when we set the recapture rate Θ=1.0. Costs incurred in the civilian sector decrease by $100, depicted on the diagram by the rectangle ABCD. Cost incurred in MTFs increase by $110. This increase is depicted by the area under the MTF marginal-cost curve over the interval from 25 to 35 visits, or the trapezoid EFGHI. The net increase in cost is equal to EFGHI minus ABCD, or just the triangle FGH ($10). We label this triangle the *efficiency effect*.



Note. Triangle FGH = efficiency effect; trapezoid HIJK = demand effect.

Figure VI-4. Workload Shift from Civilian to Military Sector: Efficiency and Demand Effects

Now relax the recapture rate to $\Theta = 1.5$. MTFs now provided an additional five visits. The cost of these five visits is $48, depicted by the area under the MTF marginal-cost curve over the interval from 35 to 40 visits, or the trapezoid HIJK. Note that MTFs are actually more efficient than the civilian sector over this range, so that the increased cost does *not* reflect an efficiency loss. Instead, we label this trapezoid the *demand effect*.

Both the efficiency and demand effects must be weighed in assessing the overall cost-effectiveness of increasing MTF capacity. The efficiency effect represents an increase in cost in our example, but one could just as easily construct examples where the efficiency effect represents a decrease in cost. In either instance, the efficiency effect must be balanced against the demand effect, which necessarily entails an increase in cost. The net effect on total cost may be of either algebraic sign. Moreover, the sign of the net effect is not by itself sufficient to judge the cost-effectiveness of increasing MTF capacity. Beneficiary health-status may improve with the increase in health-care utilization. In addition, the shift from CHAMPUS to MTFs leads to a reduction in beneficiary co-payments, again affecting beneficiary well-being. To account for all of these issues requires a combination of the MTF cost estimates presented later in this chapter, plus the companion RAND analyses of utilization and civilian-sector costs.

Finally, note that the efficiency and demand effects are most pertinent for Cases 1 and 2, because those cases involve a change in MTF capacity while preserving the basic character of military medicine. As will be seen, Cases 3 and 4 involve fundamental changes in the organization and delivery of military medical care, so the decomposition into efficiency and demand effects is not as relevant.

2. Description of Cases 1 and 2

The analytical cases are fully developed in a companion RAND publication.[4] It is not our purpose here to describe either the rationale behind each case, or the method of workload estimation. Instead, we give a summary description of Cases 1 and 2 in this subsection, then estimate the in-house cost under each case in the following subsection. We also consider an intermediate case, labeled 2C, introduced as a device to decompose the total change between Cases 1 and 2 into efficiency and demand effects.

Case 1 is a minor excursion from the historical FY92 data as reported in MEPRS. The difference reflects managed-care initiatives that had not yet been fully implemented during that year. Specifically, beneficiaries who live within catchment areas would be offered the choice between two plans:

- A variation on the current plan, under which beneficiaries receive care either at MTFs or from civilian providers under CHAMPUS. The variation occurs in that a preferred-provider feature would offer discounts for care received from civilian providers on a specified list.
- An HMO that combines MTFs with a much smaller list of civilian providers. Similar to the situation in civilian HMOs, primary-care providers would serve as "gatekeepers" to specialty care. Although patients would be managed more aggressively, they would be compensated through lower co-payments and a more generous benefit (e.g., adult preventive care); see the cited RAND publication for details. On the provider side, quality-assurance and utilization-review programs would be instituted in an attempt to improve cost-effectiveness.

Beneficiaries who live outside of catchment areas would continue to receive care from civilian providers under CHAMPUS.

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[4] "The Demand for Military Health Care: Supporting Research for a Comprehensive Study of the Military Health Care System."

As shown in Table VI-2, the system-wide difference between Case 1 and the historical data is an increase of 1.9% in the number of inpatient dispositions, and 0.1% in the number of ambulatory visits.[5] However, as shown in Figures VI-5 and VI-6, these increases in workload are not uniformly distributed across MTFs. Inpatient dispositions rise at every MTF, but the increases range from about 0.5% to slightly over 4%. Ambulatory visits actually fall at 44 MTFs, although the largest decrease is only about 0.5%.

Cases 2 and 2C offer the same benefit package as Case 1. However, Cases 2 and 2C involve an increase in MTF capacity, so some portion of CHAMPUS workload is recaptured by the MTFs. Specifically, a 94-bed hospital is constructed at Ft. McPherson, Georgia (near Atlanta) based on the size of the beneficiary population in that region. Also, a total of 949 operating beds are added at 16 other facilities, as displayed in Table VI-3. Finally, staffing is expanded at most existing hospitals, in order to more fully utilize existing bed capacity.

Table VI-2. Workload Summary for Cases 1 and 2

	MEPRS FY92 Actual	Case 1	Case 2C	Case 2
Inpatient Dispositions:				
Number (thousands)	715.9	729.4	776.5	856.3
% increase over FY92 actual	N/A	1.9%	8.5%	19.6%
Ambulatory Visits:				
Number (millions)	37.96	38.01	40.04	40.90
% increase over FY92 actual	N/A	0.1%	5.5%	7.8%

Source: Tabulations from spreadsheets provided by the RAND Corporation.

5 The slight increase in ambulatory workload and the larger increase in inpatient workload under managed care may be surprising. These workload estimates were developed by RAND through analogy with the CHAMPUS Reform Initiative (CRI) program, which is described in: Elizabeth M. Sloss and Susan D. Hosek, "Evaluation of the CHAMPUS Reform Initiative: Volume 2, Beneficiary Access and Satisfaction," RAND Corporation, R-4244/2-HA, 1993; and Susan D. Hosek, Dana P. Goldman, Lloyd S. Dixon, and Elizabeth M. Sloss, "Evaluation of the CHAMPUS Reform Initiative: Volume 3, Health Care Utilization and Costs," RAND Corporation, R-4244/3-HA, 1993. In addition to managed care, the CRI program also provided for increased access and reduced patient co-payments. The net effect of all of these factors is the *increase* in workload reported in the text.

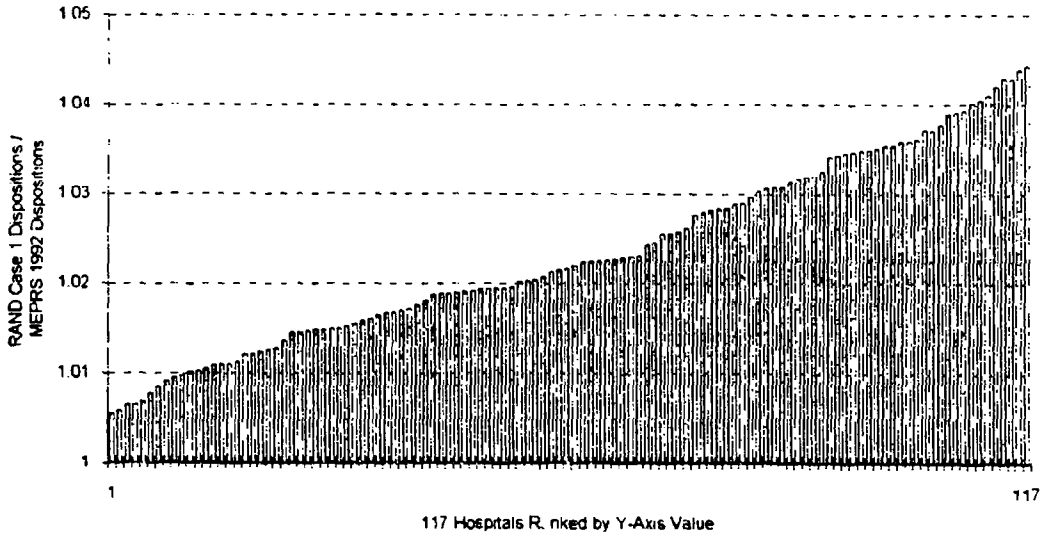

Figure VI-5. Comparison of Case 1 and MEPRS Inpatient Dispositions

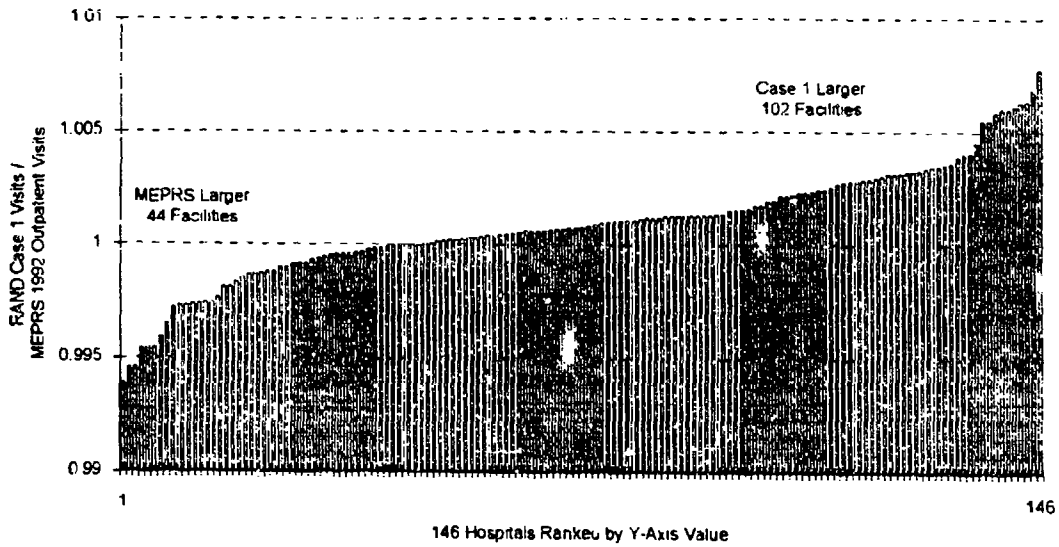

Figure VI-6. Comparison of Case 1 and MEPRS Ambulatory Visits

Table VI-3. Additional Operating Beds Under Cases 2 and 2C

MTF	State	FY92 Actual Operating Beds	Case 2/Case 2C Operating Beds	Increase in Operating Beds
MacDill AFB	FL	55	170	115
Fort Dix	NJ	36	145	109
Mather AFB	CA	35	115	80
Fort Bragg	NC	206	283	77
Tinker AFB	OK	25	89	64
Patrick AFB	FL	15	77	62
Nellis AFB	NV	35	91	56
NH Long Beach	CA	120	196	76
Davis Monthan AFB	AZ	35	72	37
Fort Eustis	VA	42	78	36
March AFB	CA	80	111	31
Offutt AFB	NE	50	81	31
Fort Lee	VA	52	73	21
Luke AFB	AZ	55	95	40
Scott AFB	IL	115	158	43
Fort Devens	MA	35	106	71
			Subtotal:	949
Fort McPherson	GA	0	94	94
			Total:	1,043

Nearly 70% of CHAMPUS expenditures are made for beneficiaries who live within 40 miles of a military hospital.[6] There would appear to be considerable potential for drawing this workload into the MTF system by increasing bed capacity and staffing. The exact criteria for adding bed capacity and staffing are described in the RAND publication. Briefly, a new hospital is constructed only if the catchment-area beneficiary population would support at least 70 beds. RAND applied a notional bed requirement of 1.5 beds per 1,000 non-Medicare (i.e., under age 65) beneficiaries, and 1.9 beds per 1,000 Medicare-eligible (i.e., age 65 or over) beneficiaries. Thus a non-Medicare population of roughly 47,000 (= 70 × 1,000/1.5) within a potential 40-mile catchment area would justify a new hospital; this number could be reduced if supplemented by a sufficient Medicare-eligible population. The only potential catchment area that satisfied these criteria was Fort McPherson.

6 "CHAMPUS Chartbook of Statistics," Office of the Civilian Health and Medical Program of the Uniformed Services, Publication 5400.2-CB, October 1992, p. II-13.

RAND applied similar criteria to determine expansions to the bed capacity of existing hospitals. However, expansion was not pursued in cases where the catchment area of the candidate hospital would overlap with that of another, larger hospital. Most notably, Fort Belvoir, Virginia, and Fort Meade, Maryland, are located in catchment areas with sizable beneficiary populations, but these populations are already being served at Walter Reed Army Medical Center (AMC) and the National Naval Medical Center (Bethesda, Maryland).

Finally, in a further effort to recapture workload in MTFs, RAND increased the physician-to-bed ratio at most existing hospitals. Specifically, RAND increased the physician full-time equivalents (FTEs) per operating bed to the value 1.2 in small hospitals, and to the value 0.9 in medium-sized hospitals and medical centers. These target values represent the respective 90th percentiles of the FY92 data. The increases in physician FTEs are reflected in the inpatient workloads that RAND provided to IDA, which increase over historical levels in greater proportion than do the number of operating beds. After accounting for planned reductions already in progress at Naval Hospital Newport (reduced from 106 to 40 beds) and at Letterman Army Medical Center (reduced from 348 to 78 beds), the system-wide percentage increases under Case 2 are 5.0% for operating beds and 13.4% for inpatient workload.

Recall that Case 2C is examined to decompose the total change between Cases 1 and 2 into efficiency and demand effects. The sole difference between Cases 2 and 2C is in the implicit recapture rate. Case 2C artificially sets the recapture rate at $\Theta = 1.0$. Relative to our earlier terminology, the movement from Case 1 to Case 2C isolates a pure efficiency effect, because the total (MTF plus CHAMPUS) workload is held constant. Note, however, that IDA has estimated only the increased *in-house* cost associated with the recapture of MTF workload. A complete analysis of the efficiency effect also requires an estimate of the reduced CHAMPUS cost, in order to compute the net effect on total cost. The CHAMPUS cost estimates are found in the RAND Corporation publication. Finally, the movement from Case 2C to Case 2 represents the demand effect, because the recapture rate is no longer artificially set at $\Theta = 1.0$. Instead, the RAND utilization analysis implicitly allows a greater than one-for-one increase in workload at MTFs.

Table VI-2 shows the system-wide differences among all the cases. Compared to historical FY92 data, Case 2C shows an increase of 8.5% in the number of inpatient dispositions, and 5.5% in the number of ambulatory visits. Case 2 is a larger departure

from history, with increases of 19.6% in the number of inpatient dispositions and 7.8% in the number of ambulatory visits. Note that in both cases inpatient workload increases by a much higher percentage than does ambulatory workload. This difference stems from the underlying difference in the inpatient and ambulatory recapture rates implicit in RAND's workload estimation. Considering CHAMPUS-eligible (i.e., under age 65) beneficiaries living inside catchment areas, RAND reports ambulatory recapture rates of 1.56 for active-duty dependents, 1.79 for retirees, survivors, and their dependents, and 1.67 overall. For the same population group, RAND reports a substantially larger inpatient recapture rate of 2.5.

The increases in workload are again not spread uniformly across MTFs. The distributions of workload increase by MTF are shown in Figures VI-7 and VI-8 for Case 2C, and Figures VI-9 and VI-10 for Case 2. Workload rises at virtually every MTF, but the percentage increases are variable. In particular, ten MTFs experience a doubling or more of inpatient dispositions under Case 2.

3. Cost Estimates for Cases 1 and 2

We estimated the MTF costs for the analytical cases by substituting the RAND workload projections into the cost functions developed in Chapter V. Recall that the RAND workload projections are based on models calibrated from the 1992 DoD Health Care Survey. However, these workloads are measured along a different scale from the MEPRS workloads used in estimating the IDA cost functions. The exchange rates (illustrated in Figure V-11) were used to translate workloads from one scale to the other. The use of exchange rates is valid on the assumption that the historical relationships between the two measurement systems will be maintained under the analytical cases.

Recalling the cost functions reported in Chapter V, we can see that DoD community hospitals exhibit diminishing marginal costs. As always, both the efficiency and demand effects must be weighed in making an overall comparison between the analytical cases. Moreover, the current (i.e., FY92) unit-cost difference between military and civilian hospitals is not sufficient for making the comparison. If, hypothetically, military hospitals were currently more expensive, that difference might disappear as MTFs were expanded and increasing returns came into play. A correct evaluation can be made only by comparing *total* costs between the various analytical cases, not by examining average or marginal costs under current conditions.

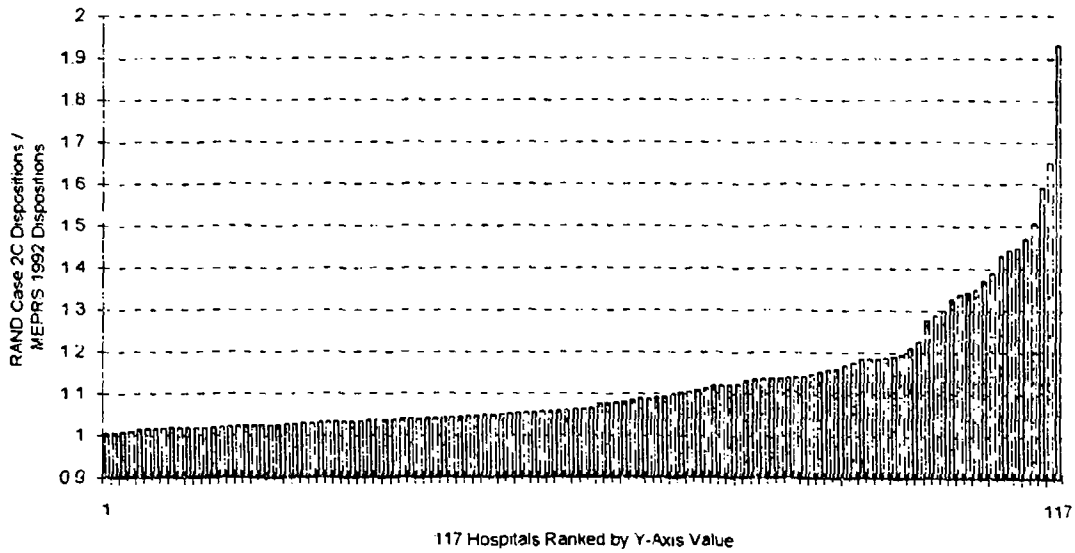

Figure VI-7. Comparison of Case 2C and MEPRS Inpatient Dispositions

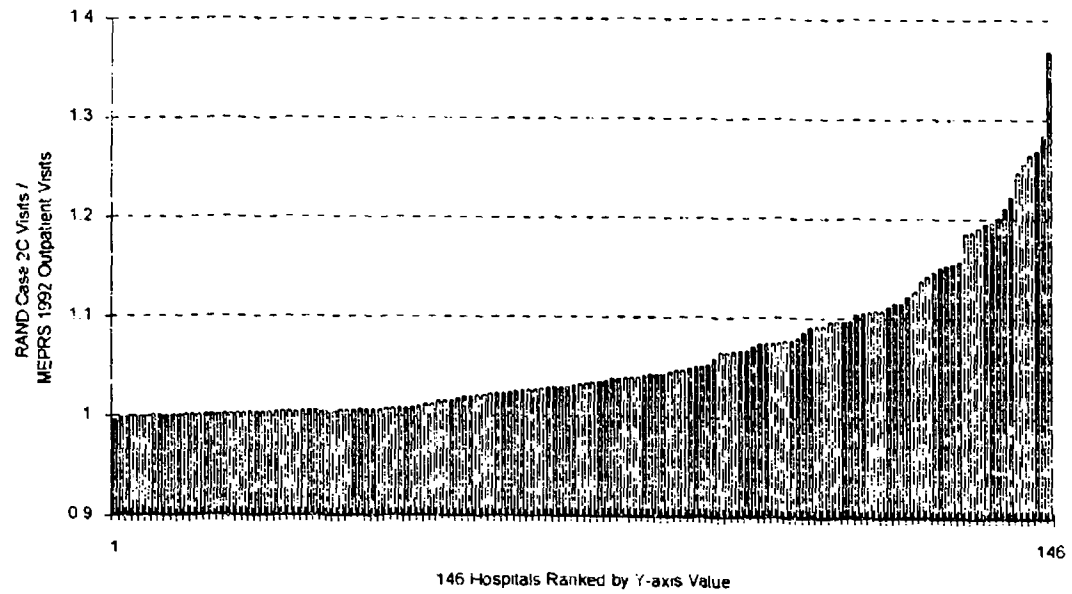

Figure VI-8. Comparison of Case 2C and MEPRS Ambulatory Visits

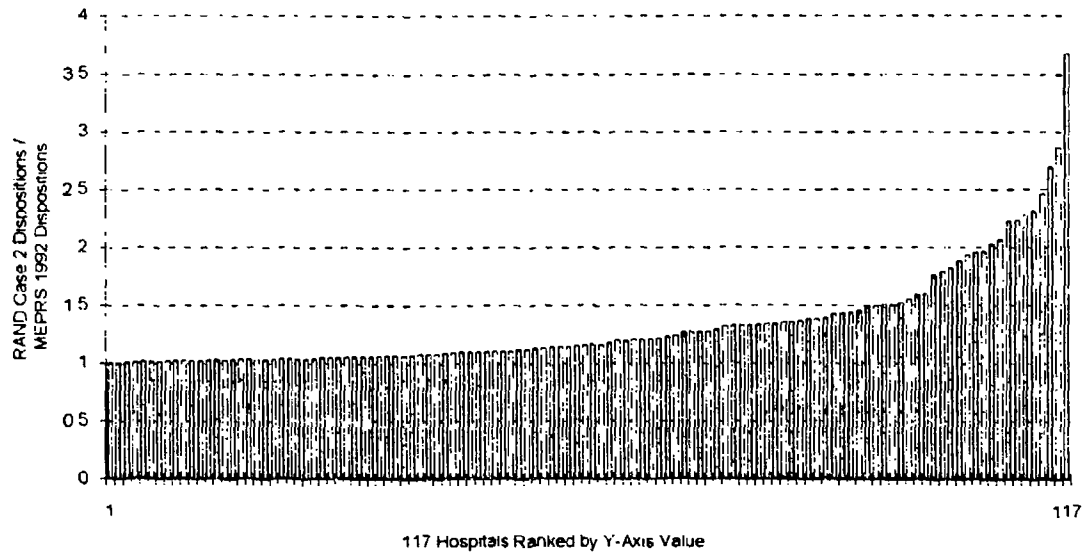

Figure VI-9. Comparison of Case 2 and MEPRS Inpatient Dispositions

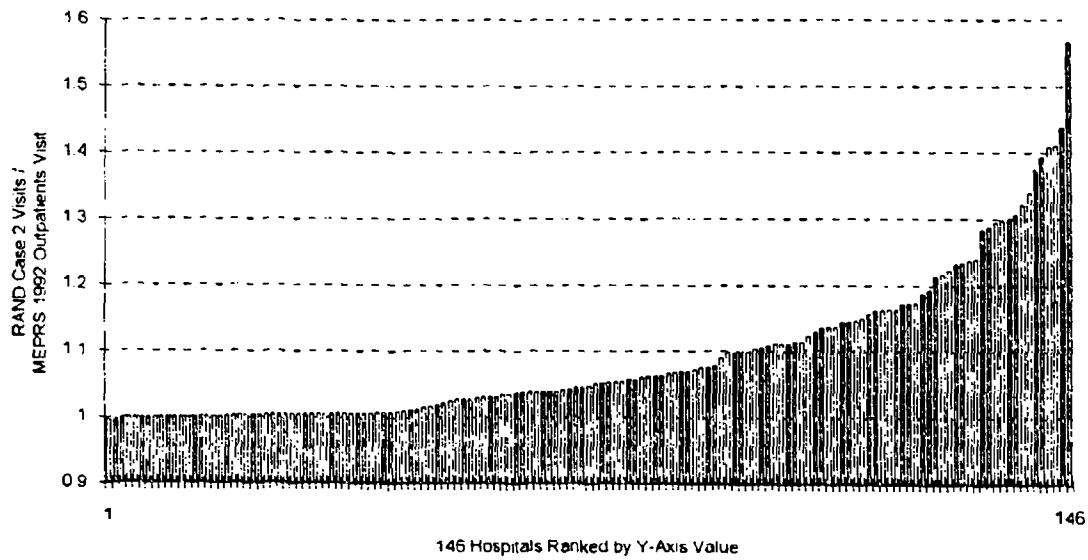

Figure VI-10. Comparison of Case 2 and MEPRS Ambulatory Visits

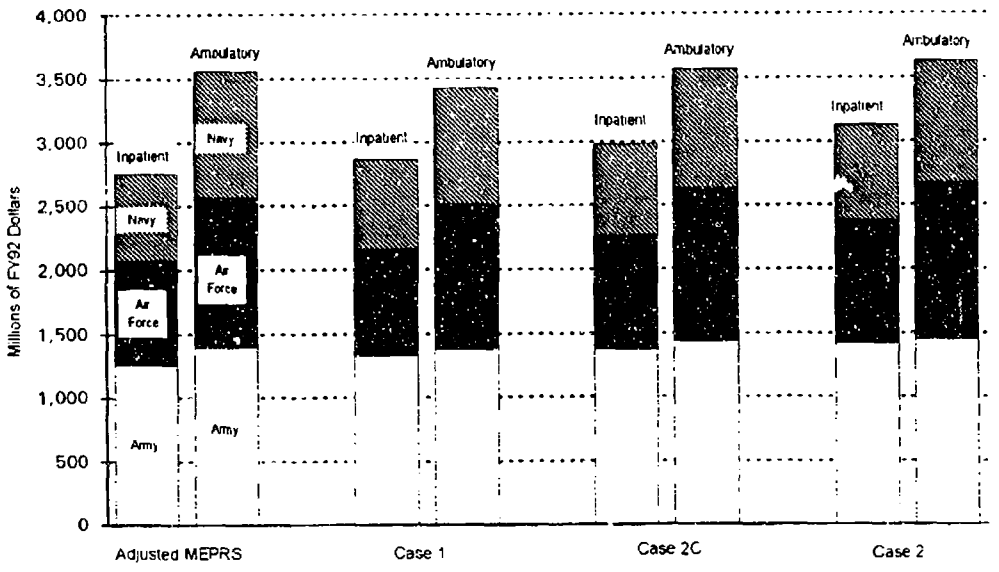

Figure VI-11. Cost Breakout for Cases 1 and 2

The detailed estimates of DoD in-house cost, summarized in Figure VI-11, are shown in Table VI-4. The "MEPRS FY92 Reported" column in the table shows reported inpatient and ambulatory costs for FY92. The "MEPRS FY92 Adjusted" column represents an application of the MEPRS adjustment factors developed in Chapter III (Figure III-7). This column gives a more accurate and comprehensive estimate of historical costs than that found in the standard reporting systems, and is the appropriate metric for evaluating the analytical cases.

The increased in-house cost of moving from Case 1 to Case 2C is $265 million or 4.2%. Computation of the *net* cost change requires an estimate of the corresponding reduction in CHAMPUS cost, which is found in the RAND Corporation publication. The net cost change in moving from Case 1 to Case 2C measures the efficiency effect described earlier. The full movement to Case 2 incorporates the demand effect as well as the efficiency effect, because total (MTF plus CHAMPUS) workload is not constrained to remain constant. The demand effect leads to an additional increase in MTF cost of $206 million or 3.2%. The full increase in MTF cost of $471 million or 7.5% is relatively small, because it results from the addition of only 1,043 operating beds system-wide.

Table VI-4. Cost Breakout for Cases 1 and 2
(Millions of FY92 Dollars)

		MEPRS FY92 Reported	MEPRS FY92 Adjusted	Case 1	Case 2C	Case 2
Inpatient						
Army	Medical Center	688.4	799.9	853.0	865.3	883.8
	Hospital	393.7	457.5	471.3	508.4	538.3
Air Force	Medical Center	383.7	432.5	456.0	463.7	478.2
	Hospital	335.7	378.3	372.6	419.8	474.2
Navy	Medical Center	373.4	420.8	418.7	419.9	422.7
	Hospital	236.8	266.9	291.6	305.7	332.9
Inpatient Total		2,411.7	2,755.9	2,863.1	2,982.7	3,130.1
Ambulatory						
Army	Medical Center	527.9	593.9	584.3	591.0	594.1
	Hospital	696.6	783.7	775.1	826.8	838.7
	Clinic	19.0	21.4	17.6	17.6	17.6
Air Force	Medical Center	295.8	326.9	312.7	317.9	320.4
	Hospital	658.9	728.1	706.6	795.7	786.0
	Clinic	98.1	108.3	110.8	114.3	116.1
Navy	Medical Center	362.4	400.8	335.1	336.0	336.4
	Hospital	457.7	506.2	486.1	510.1	522.9
	Clinic	81.7	90.4	93.6	93.9	93.9
Ambulatory Total		3,198.1	3,559.6	3,421.9	3,567.3	3,626.2
Total Cost		5,609.8	6,315.5	6,284.9	6,549.9	6,756.3

4. Reconciliation of Cost Projections with the FYDP

The MTF costs from the "MEPRS FY92 Adjusted" column of Table VI-4 may be added to the CHAMPUS costs estimated by RAND, giving an indication of total peacetime medical costs during that fiscal year. This sum is necessarily smaller than the total medical cost in Major Force Program 8 of the Future Years Defense Program (FYDP), because certain program elements relate to wartime readiness or other missions apart from peacetime care. This point is explored in Table VI-5. The selection and classification of Program Elements (PEs) is based on the OASD (Health Affairs) Cost of Medical Activities (COMA) data book,[7] with minor modifications. One difference is that

[7] "Defense Health Program. Data Book, Fiscal Year 1994, Cost of Medical Activities." Office of the Assistant Secretary of Defense (Health Affairs). 1993

Table VI-5. Reconciliation of FY92 Medical Obligations in Major Force Program 8

Category	Program Element	Description	Funding	Subtotal	Cumulative FYDP Total	MEPRS Reported	MEPRS Adjusted
Patient Care, Excluding Dental	0807711	Care in Regional Defense Facilities	$2,317,862				
	0807792	Station Hospitals and Medical Clinics	$3,936,866				
				$6,254,728	$6,254,728		
Base Support	0807756	Environmental Compliance	$5,818				
	0807776	Minor Construction, Health Care	$2,661				
	0807778	Maintenance and Repair, Health Care	$52,165				
	0807790	Visual Information Activities	$9,513				
	0807795	Base Communications, Health Care	$30,952				
	0807796	Base Support, Health Care	$564,563				
				$665,672	$6,920,400	$5,609,788	
PEs Used in IDA Adjustments to MEPRS	0807716	Medical Facilities, Planning & Design	$40,623				
	0807717	Medical Facilities, Military Construction	$230,600				
	0807791	Defense Medical Program Activity	$116,705				
	0807798	Management Headquarters, Medical	$50,065				
				$437,993	$7,358,393		$6,315,506
CHAMPUS	0807712	CHAMPUS	$3,763,999				
				$3,763,999	$11,122,392		
Dental	0807715	Dental Care Activities	$616,093				
				$616,093	$11,738,485		
Education and Training	0806721	Uniformed Services University of the Health Sciences (USUHS)	$80,330				
	0806722	Armed Forces Scholarship Program	$97,079				
	0806761	Education and Training, Health Care	$907,561				
				$1,084,971	$12,823,456		
Other Patient Care Support	0801712	Examining Activities	$23,522				
	0807713	Care in Non-Defense Facilities	$519,910				
	0807714	Other Health Activities	$1,050,164				
				$1,593,596	$14,417,051		

Note: Costs are in thousands of FY92 dollars.

we display the FYDP total from all appropriations, whereas the COMA data book concentrates on the Operations and Maintenance (O&M) appropriation.[8] The four PEs in the category "PEs Used in IDA Adjustments to MEPRS" approximate the adjustments described previously in Chapter III. However, those adjustments were based on FY90 data, whereas the current table is based on FY92 data. Note that PEs 0807716 (Medical Facilities, Planning and Design) and 0807717 (Medical Facilities, Military Construction) are included here to proxy for the construction-cost adjustment to MEPRS. These two PEs do not appear in the COMA report, because they are funded outside of the O&M account.

It is impossible to develop a complete reconciliation between MEPRS and the FYDP, partly because FYDP obligations translate into outlays over a multi-year time window. In addition, there is no standard crosswalk between MEPRS and any particular subset of PEs, nor is it our intention to create such a crosswalk here.[9] Finally, the IDA adjustments include both a reallocation of costs reported within MEPRS (i.e., factoring back some of the Special Programs accounts), and the addition of costs omitted from MEPRS (e.g., management headquarters).

With these qualifications, the cumulative FYDP total for "Patient Care, Excluding Dental" plus "Base Support" should approximate the "MEPRS Reported, Excluding Dental." In fact, the former ($6.92 billion) is 23.4% larger than the latter ($5.61 billion). Similarly, the cumulative FYDP total, including "IDA Adjustments to MEPRS," should approximate the "MEPRS Adjusted, Excluding Dental." In this case, the former ($7.36 billion) is 16.5% larger than the latter ($6.32 billion). The reduction in the discrepancy that is apparent when looking at the *adjusted* subtotals is some indication that the adjustment is working in the correct direction.

Further adding the RAND estimate of CHAMPUS expenses should approximate the cumulative FYDP total of $11.1 billion. Even this figure falls short of the Program 8 total of $14.4 billion, because the latter includes $616 million in Dental Care Activities,

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8 As reviewed in Chapter II, the 1991 COMA report contained FY90 data for all appropriation categories, not just O&M. FY90 was apparently the last year for which all appropriation categories were reported. Note also that the FY90 COMA report, as well as the IDA analysis reported in Chapters II and IV, identified additional medical resources outside of Major Force Program 8. Those resources, primarily related to the structural medical requirement, are ignored in the current discussion.

9 A partial crosswalk for the Air Force is given in Air Force Regulation 170-5 (15 May 1992). We are not aware of any corresponding regulations for the other two Services. Moreover, even the Air Force regulation does not address adjustments for cost elements excluded from MEPRS (e.g., as reflected in the OSD program elements).

plus a total of nearly $2.7 billion in Examining Activities, Care in Non-Defense Facilities (i.e., supplemental care), Other Health Activities, and training activities not already subsumed in the other PEs. We treat these activities as "below the line," and we do not attempt to model them with even the adjusted MEPRS data. Rather, they should be added back to the sum of the IDA and RAND estimates for any analytical cases under consideration. If these activities are expected to change under an analytical case, then that calculation should be conducted independently of either the IDA or RAND cost analyses.

Program Element 0807714 (Other Health Activities) includes, among other things, spending for wartime contingencies. A portion of this PE may correlate to the MEPRS F accounts, though not to any of the three-digit peacetime-related F accounts identified for the MEPRS adjustments in Chapter III. Also as discussed in Chapter III, we treat PE 0806721 [Uniformed Services University of the Health Sciences (USUHS)] and PE 0806722 (Armed Forces Scholarship Program) as "below the line," because they do not represent patient care provided in MTFs.

Program Element 0806761 (Education and Training, Health Care) is a catch-all account that is difficult to fully reconcile with MEPRS. For students being trained at MTFs (as opposed to USUHS or civilian hospitals), salary expenses are captured either in MEPRS account FAK (Student Expenses) or else directly in the Inpatient or Ambulatory accounts. Expenses other than student salaries (e.g., instructor salaries, medical library, medical illustration and medical photography) are reported in MEPRS accounts EBE (Graduate Medical Education Support) and EBF (Education and Training Support). Accounts EBE, EBF, and FAK may correlate to PE 0806761, but the data systems are not adequate to allow complete reconciliation of the dollar totals.

More research is required in order to fully account for the $2.7 billion in Examining Activities, Care in Non-Defense Facilities, Other Health Activities, and miscellaneous training activities. To the extent that these costs are fixed (i.e., independent of the level of MTF workload), they cancel out in comparisons between the various analytical cases considered in the Section 733 Study. But to the extent that these costs are variable, we may have understated the cost differences between the analytical cases. Future improvements in OSD-level data systems may facilitate a finer decomposition of subsequent years' FYDP data.

Finally, note that reconciliation with the FYDP is most relevant for Case 1, because this case most closely resembles the status quo as reflected in historical budget data. It would make little sense to even attempt to reconcile historical budget data with a completely counterfactual analytical case. However, it remains true for all of the analytical cases that "below the line" costs, adjusted where appropriate, should be added to the sum of the IDA and RAND cost estimates.

B. ANALYTICAL CASE 3

1. Description of Case 3

Case 3, the "Minimal-MTF Case," attempts to shift as many beneficiaries as possible to civilian health-care, while retaining the military's capacity to treat wartime casualties. The facilities and staff required for wartime are employed in peacetime primarily to care for active-duty personnel. However, the active-duty clinical mix may not provide the necessary training opportunities for military physicians. Therefore, some care is still provided to non-active duty beneficiaries. For example, cardio/thoracic surgeons may require a number of patients over age 65 to provide opportunities for heart surgery.

There are actually two versions of Case 3. Under Case 3A ("Reception-and-Referral"), only six MTFs are retained in CONUS. These six MTFs, shown in Table VI-6, are sufficient for reception of wartime evacuees and referral to either civilian or Veterans Administration hospitals. Dover AFB is included not because of its small hospital (20 operating beds in FY92, not factored into the totals), but rather because of its traditional role in receiving wartime evacuees. The total number of peacetime operating beds under Case 3A is 2,875.

Under Case 3B, Dover AFB is dropped, but six additional MTFs are added, five in CONUS plus Tripler AMC at Fort Shafter, Hawaii. The total of eleven MTFs provide 4,071 peacetime operating beds. After major wartime reconfiguration, these eleven MTFs are sufficient to provide the first sixty days of care required by wartime evacuees under some of the scenarios. Beyond that period, patients are again released to the Veterans Administration.

Table VI-6. Military Hospitals, Cases 3A and 3B

Hospital	Location	FY92 Peacetime Operating Beds	Year Constructed or Last Modified
Reception-and-Referral (Case 3A):			
NH San Diego	San Diego, CA	393	1987
Walter Reed AMC	Washington, DC	737	1991
Wilford Hall USAF Medical Center	Lackland AFB, TX	1,000	1989
NH Portsmouth	Portsmouth, VA	446	1983
Madigan AMC	Fort Lewis, WA	299	1992
436th USAF Medical Group[a]	Dover AFB, DE	N/A	1984
	Subtotal:	2,875	
Additional MTFs for Case 3B:			
NH Jacksonville	Jacksonville, FL	131	1990
Tripler AMC	Fort Shafter, HI	458	1991
Blanchfield ACH	Fort Campbell, KY	109	1982
Womack ACH	Fort Bragg, NC	195	1991
NH Camp Lejeune	Camp Lejeune, NC	176	1983
Darnall ACH	Fort Hood, TX	127	1985
	Total:	4,071	

a Included in Case 3A but excluded from Case 3B.

The eleven MTFs were selected by RAND within guidelines provided by OD(PA&E). These MTFs are among the newer and better-equipped, as indicated by the modification dates in the table. There was also some effort to obtain geographical dispersion, in order to reduce travel distances between recovering casualties and their families. Most of the eleven MTFs are located close to either major naval ports or Air Mobility Command (AMC) bases; Dover AFB was dropped because its reception role would be supplanted by these AMC bases. For example, Walter Reed Army Medical Center would be serviced by the 89th Air Wing, operating out of Andrews AFB, Maryland; and Madigan Army Medical Center by the 62nd Air Wing operating out of McChord AFB, Washington. The two MTFs in Texas would presumably be serviced by the 463rd Air Wing operating out of Dyess AFB; and the two MTFs in North Carolina by the 317th Air Wing operating out of Pope AFB. Other choices of MTFs would have been possible, for example, David Grant USAF Medical Center at Travis AFB, California (225 operating beds), or Malcolm Grow USAF Medical Center at Andrews AFB, Maryland (210 operating beds). Although both of these are AMC bases, their capacity was subsumed by larger, nearby medical centers already in the minimal set on each respective coast.

Finally, the RAND analysis indicates that system-wide costs are not sensitive to the exact identities of the eleven MTFs, as long as system-wide capacity and the general geographical pattern are preserved under alternative configurations.

It remains to specify the arrangements for peacetime care under Cases 3A and 3B. The eleven MTFs would provide most of the care for active-duty personnel in their catchment areas, and would likely expand the services they provide to active-duty personnel referred from other areas. Outside of these eleven MTFs, most of the roughly 100 remaining CONUS MTFs would be converted to ambulatory clinics, serving active-duty personnel *exclusively*. The exact number of conversions depends on the subcase being considered; under Case 3A, the six "Additional MTFs" in the lower panel of Table VI-6 are converted to clinics as well. In addition, RAND considers subcases for both FY92 and FY97; the latter incorporates base closures planned as of this writing. The four subcases (3A versus 3B, FY92 versus FY97) are described in detail in the RAND report.[10] Finally, 29 ambulatory clinics in CONUS currently report cost and workload directly into MEPRS, rather than reporting through a parent hospital. RAND required that a clinic have an active-duty population of at least 1,600 to remain viable. Based on this criterion, only 8 of the 29 independently reporting clinics remain under Case 3; this figure is the same for all subcases. The eight surviving clinics will be highlighted in the tables to follow.

Non-active-duty beneficiaries would receive medical care through civilian health plans. Beneficiaries would have a choice of enrolling in one of up to three types of plans, depending on geographical availability: a Fee-for-Service (FFS) plan, a Preferred-Provider Organization (PPO), or an HMO. Currently, commercial FFS plans are available everywhere throughout the United States, while PPOs and HMOs are absent from some small cities and most rural areas. However, DoD could encourage the spread of PPOs and HMOs in rural areas with large military populations, and these plans are likely to spread anyway in light of national health reform.

The benefit packages for non-active duty beneficiaries would vary, depending on the type of plan chosen. The FFS plans would have the same co-payments and deductibles currently found in CHAMPUS, and would cover the same set of medical services as well. The PPO plans would offer a restricted set of medical providers, but would lower the

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10 "The Demand for Military Health Care: Supporting Research for a Comprehensive Study of the Military Health Care System."

beneficiary cost-share by 5 percentage points. Finally, the HMO plans would offer the same benefits and services as the managed-care option in Cases 1 and 2. Further details are found in the previously cited RAND publication.

As mentioned earlier, the active-duty population alone would not provide the correct mix of clinical cases to maintain training opportunities for military physicians. Moreover, even notwithstanding the mix of cases, the active-duty populations would not provide sufficient numbers of inpatient admissions to utilize existing capacity at the eleven MTFs under Case 3B. In FY92, the eleven MTFs admitted about 224,000 patients, of which only 28% were active-duty personnel. The total number of active-duty admissions at all MTFs was roughly 200,000, but it would be prohibitively expensive to transport this number of patients to the remaining eleven MTFs. Instead, many of the active-duty admissions outside of the eleven catchment areas would be referred to civilian hospitals.[11] However, the eleven remaining MTFs plus the MTFs converted to clinics would continue to provide most of the ambulatory care for the active-duty population. The catchment areas of the eleven MTFs would include about 40% of all active-duty personnel in CONUS; including the converted clinics would raise this figure to nearly 90%.

The remaining capacity at the eleven MTFs under Case 3B would be filled by non-active-duty beneficiaries, under the auspices of civilian health plans. Similar to some existing contractual arrangements, civilian health plans would be required to refer admissions to MTFs, and reimburse the MTFs for services provided. In our cost analysis, these costs are charged against the *civilian* health plans, even though the care is actually provided at MTFs. As described below, our cost analysis of Case 3 includes only the active-duty patients who receive care at MTFs; the cost of civilian health plans is estimated by RAND.

Whereas eleven MTFs remain open under Case 3B, only six MTFs remain open under Case 3A. The smaller total capacity at these six MTFs could more easily be filled by referrals of active-duty patients from outside the six catchment areas, thus it might not prove necessary for civilian health plans to treat non-active duty patients at MTFs. Because of reduced capacity, however, a greater share of the active-duty workload would have to be referred to civilian hospitals.

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[11] Referrals of active-duty patients to civilian hospitals are common even under current arrangements. In FY92, some $519 million were spent on "supplemental care" (Program Element 0807713), much of which falls into this category.

2. Cost Estimates for Case 3

Under Case 3B, eleven complete MTFs provide both inpatient and ambulatory care, and 104 MTFs converted to clinics provide ambulatory care only. Six more MTFs are converted to clinics under Case 3A, though the small hospital at Dover AFB is added, leaving six complete MTFs plus a total of 110 MTFs converted to clinics. In addition, both cases have estimates for FY92 and FY97, since some of the MTFs converted to clinics in FY92 will be eliminated by FY97. Finally, all subcases contain eight currently existing clinics that report independently through MEPRS.[12]

To construct the cost estimates for Cases 3A and 3B, the facilities are separated into two groups: (1) the complete MTFs, that still provide inpatient as well as ambulatory care; and (2) the MTFs converted to ambulatory clinics, plus the eight independently reporting clinics. The costs of the complete MTFs are identical for FY92 and FY97, because none of these MTFs are scheduled for closure. However, the total cost of the clinics is lower in FY97 than in FY92, because sixteen clinics are scheduled for closure.

We state in Chapter V that the MTFs' cost functions need not predict cost exactly at each individual MTF, as long as the errors average out across the entire population of MTFs. However, we retain fewer than a dozen, non-randomly chosen MTFs under Case 3. It is conceivable that the errors do not average out across this small subset of the MTF population, so our cost functions systematically under- or over-predict cost. Figure VI-12 addresses this concern by showing a histogram of the percentage errors in predicting FY92 cost for the MTFs retained under Case 3B; positive values indicate that observed cost exceeds predicted cost. The histogram reveals no serious outliers (i.e., percentage errors in excess of ±20%), nor any systematic bias toward either positive or negative prediction errors. Thus, the cost functions appear to be valid when applied to the Case 3 subpopulation.

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[12] In the estimates for both years, Walson Hospital (Fort Dix, New Jersey) is transferred to nearby McGuire AFB, and the 323rd Medical Group (Mather AFB, California) is transferred to McClellan AFB. These two actions represent base closures that have already taken effect. Further, we assumed that the new hospitals inherit the same workloads observed at the old hospitals.

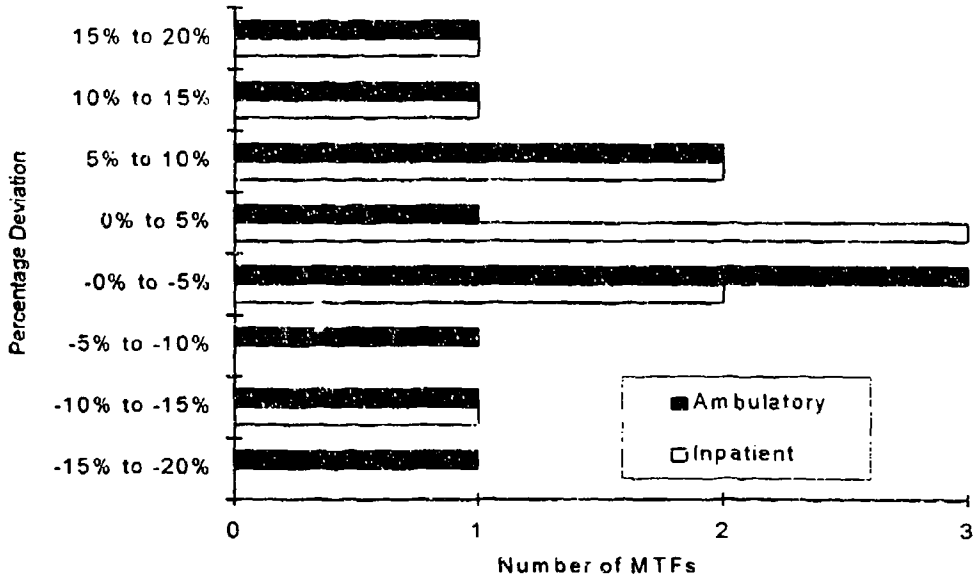

Figure VI-12. Percentage Deviation Between Observed and Predicted FY92 Expenses, MTFs Included in Case 3B

a. Inpatient Costs for the Complete MTFs

RAND estimated the workloads for Case 3 inpatient care, by clinical area and by two beneficiary categories: active-duty and "other." We adjusted the workload in each clinical area to yield case-mix adjusted (CMA) dispositions. Our database contains facility-specific case-mix indices (CMIs) for the following beneficiary categories: (1) active duty, (2) retirees under age 65, (3) other beneficiaries under age 65, and (4) beneficiaries age 65 and over. We constructed a CMI for the aggregation of categories (2) through (4) (corresponding to the RAND "other" category) using the baseline information from Case 1:

$$(1) \qquad \text{Non - Active Duty CMI} = \frac{\text{(Total Non - Active Duty CMA Dispositions in Case 1)}}{\text{(Total Non - Active Duty Dispositions in Case 1)}}.$$

We then estimated non-active-duty CMA workload for Case 3 as the product of the CMI with the raw number of non-active-duty dispositions provided by RAND.

Two equations based on Table V-5 were used to estimate the respective costs of inpatient care at community hospitals and at medical centers:

(2) $$\text{Hospital Cost} = 1{,}081{,}343 + 3{,}202(\text{CMA Dispositions}) - 0.66012(\text{CMA Dispositions})^2 + 65{,}862(\text{GME}) + 35{,}256(\text{Operating Beds}).$$

(3) $$\text{Medical Center Cost} = 9{,}548{,}815 + 2{,}979(\text{CMA Dispositions}) + 65{,}862(\text{GME}) + 35{,}256(\text{Operating Beds}).$$

For the Navy, equations (2) and (3) were multiplied by 1.0736, the Navy adjustment factor. Graduate medical education was measured by the number of residents plus interns, and hospital capacity by the number of operating beds. The latter two variables were set at the same values as in Case 1.

In attempting to isolate the active-duty share of total cost, we would not simply substitute active-duty dispositions into the cost equations shown above. First, the intercept must be apportioned between the active-duty beneficiaries and all other beneficiaries; simple substitution would have burdened the active-duty population with the entire intercept. Second, the squared term in equation (2) implies that the cost of active-duty care is lower when accompanied by other care provided in the same hospital; this phenomenon reflects returns-to-scale. To avoid these difficulties, the Case 3 total cost of inpatient care was factored down by RAND's facility-specific estimate of the ratio between active-duty CMA workload and total CMA workload:

(4) $$\text{Cost of Active - Duty Inpatient Care} = (\text{Total Inpatient Cost}) \times \frac{(\text{Active - Duty CMA Dispositions})}{(\text{Active - Duty CMA Dispositions} + \text{Other CMA Dispositions})}.$$

Tables VI-7 and VI-8 contain the inpatient cost estimates for Cases 3A and 3B. Note that all costs are the same for both FY92 and FY97.

b. Ambulatory Costs for the Complete MTFs

For the eleven complete facilities, the total Case 3 inpatient dispositions provided by RAND differed from the total Case 1 inpatient dispositions by less than 2%. Therefore, we assumed that total Case 3 *ambulatory visits* (which RAND did not provide) were the same as in Case 1.

Table VI-7. Active-Duty Inpatient Costs, Case 3A

S[a]	Type[b]	DMIS ID[c]	MTF	State	Adjusted MEPRS FY92 Expense	Case 3 Cost of Total Inpatient Care	Case 3 Cost of Active-Duty Inpatient Care
A	MC	37	Walter Reed AMC	DC	193,197,802	178,759,573	143,637,027
A	MC	125	Madigan AMC	WA	113,200,371	94,841,700	40,159,044
F	H	36	Dover AFB	DE	4,067,020	6,544,288	3,247,536
F	MC	117	Wilford Hall Medical Center	TX	178,110,948	186,957,335	94,715,287
N	MC	29	NH San Diego	CA	134,647,364	146,114,465	112,912,181
N	MC	124	NH Portsmouth	VA	102,090,545	126,233,081	83,907,194
			Total		725,314,050	739,450,441	478,578,270

a Service codes: A=Army, F=Air Force, N=Navy.
b Hospital types: H=Community Hospital, MC=Medical Center.
c Defense Medical Information System (DMIS) identification number.

Table VI-8. Active-Duty Inpatient Costs, Case 3B

S[a]	Type[b]	DMIS ID[c]	MTF	State	Adjusted MEPRS FY92 Expense	Case 3 Cost of Total Inpatient Care	Case 3 Cost of Active-Duty Inpatient Care
A	H	60	Blanchfield ACH	KY	25,822,738	31,529,147	15,384,497
A	H	110	Darnall ACH	TX	36,126,308	36,770,526	17,335,847
A	MC	37	Walter Reed AMC	DC	193,197,802	178,759,573	143,637,027
A	MC	52	Tripler AMC	HI	112,600,708	109,279,048	35,459,180
A	MC	89	Womack ACH	NC	38,104,421	67,174,963	36,594,764
A	MC	125	Madigan AMC	WA	113,200,371	94,841,700	40,159,044
F	MC	117	Wilford Hall Medical Center	TX	178,110,948	186,957,335	94,715,287
N	H	39	NH Jacksonville	FL	30,175,185	29,384,820	13,249,259
N	H	91	NH Camp Lejeune	NC	24,569,619	27,093,177	15,781,262
N	MC	29	NH San Diego	CA	134,647,364	146,114,465	112,912,181
N	MC	124	NH Portsmouth	VA	102,090,545	126,233,081	83,907,194
			Total		988,646,010	1,034,137,835	609,135,543

a Service codes: A=Army, F=Air Force, N=Navy.
b Hospital types: H=Community Hospital, MC=Medical Center.
c Defense Medical Information System (DMIS) identification number.

For Case 3, we are interested in the cost of providing care to *active-duty* beneficiaries only; the costs for other beneficiary groups are subsumed in the civilian health plans analyzed by RAND. Two equations based on Table V-7 were used to estimate the respective costs of ambulatory care at community hospitals and at medical centers:

(5) Hospital Cost = -105,024 + 100(Total Visits) - 0.0000527(Total Visits)^2 + 102,915(GME).

(6) Medical Center Cost = 19,814,482 + 42(Total Visits) + 102,915(GME).

For the Navy, equations (5) and (6) were multiplied by 1.1241, the Navy adjustment factor.

The cost of active-duty ambulatory care was estimated by applying to total cost the facility-specific ratio of active-duty visits to total visits from Case 1:

(7) Cost of Active-Duty Ambulatory Care = (Total Ambulatory Cost) × (Active Duty Visits) / (Total Visits)

Tables VI-9 and VI-10 show the estimated ambulatory costs in the complete MTFs for Cases 3A and 3B, respectively. Note that all costs are the same for both FY92 and FY97.

Table VI-9. Active-Duty Ambulatory Costs for Complete MTFs, Case 3A

S[a]	Type[b]	DMIS ID[c]	MTF	State	Adjusted MEPRS FY92 Expense	Case 3 Cost of Total Ambulatory Care	Case 3 Cost of Active-Duty Ambulatory Care
A	MC	37	Walter Reed AMC	DC	113,902,999	100,512,211	32,382,714
A	MC	125	Madigan AMC	WA	87,356,350	76,253,086	23,262,369
F	H	36	Dover AFB	DE	9,457,436	12,891,800	4,205,136
F	MC	117	Wilford Hall Medical Center	TX	106,061,963	97,010,905	25,944,750
N	MC	29	NH San Diego	CA	112,155,149	106,291,272	60,141,052
N	MC	124	NH Portsmouth	VA	101,630,540	100,968,541	49,024,548
			Total		530 564,437	493,927,815	194,960,560

a Service codes: A=Army, F=Air Force, N=Navy.
b Hospital types: H=Community Hospital, MC=Medical Center.
c Defense Medical Information System (DMIS) identification number.

Table VI-10. Active-Duty Ambulatory Costs for Complete MTFs, Case 3B

S[a]	Type[b]	DMIS ID[c]	MTF	State	Adjusted MEPRS FY92 Expense	Case 3 Cost of Total Ambulatory Care	Case 3 Cost of Active-Duty Ambulatory Care
A	H	60	Blanchfield ACH	KY	39,057,253	43,025,713	20,112,328
A	H	110	Darnall ACH	TX	47,341,713	48,941,242	18,931,662
A	MC	37	Walter Reed AMC	DC	113,902,999	100,512,211	32,382,714
A	MC	52	Tripler AMC	HI	77,083,310	76,198,084	25,097,667
A	MC	89	Womack ACH	NC	55,744,548	64,503,175	30,727,914
A	MC	125	Madigan AMC	WA	87,356,350	76,253,086	23,262,360
F	MC	117	Wilford Hall Medical Center	TX	106,061,963	97,010,905	25,944,750
N	H	39	NH Jacksonville	FL	53,902,517	45,362,648	18,727,433
N	H	91	NH Camp Lejeune	NC	30,892,958	36,327,827	19,859,435
N	MC	29	NH San Diego	CA	112,155,149	106,291,272	60,141,052
N	MC	124	NH Portsmouth	VA	101,630,540	100,968,541	49,024,548
			Total		825,129,300	795,394,705	324,211,863

a Service codes: A=Army, F=Air Force, N=Navy.
b Hospital types: H=Community Hospital, MC=Medical Center.
c Defense Medical Information System (DMIS) identification number.

c. Ambulatory Costs for the Clinics

We made the following assumptions in order to estimate the cost of ambulatory-clinic care under Case 3. In both the eight existing clinics and the MTFs converted to clinics, the active-duty ambulatory workload remains the same as in Case 1. Moreover, the non-active-duty ambulatory workload and any inpatient workload disappear. Finally, all GME is eliminated from the MTFs converted to clinics.

After eliminating the factor for GME, Table V-7 implies the following equation for the total cost of ambulatory care in a clinic:

(8) Cost of Clinic Care = 1,181,398 + 69(Total Visits).

For the Navy, equation (8) was again multiplied by 1.1241, the Navy adjustment factor. Unlike the case for the complete MTFs, the active-duty share of ambulatory cost in equation (8) includes the entire intercept ($1.18 million), not just an apportioned share. This result holds because, under Case 3, only the active-duty workload is retained at the clinics.

As described in the RAND report, some of the facilities converted to clinics in FY92 will be eliminated by FY97. In Table VI-11 the facilities remaining open in FY97 are marked with an "x" in the column labeled "FY97". The eight existing clinics are highlighted with asterisks. Table VI-11 contains all of the clinics for Case 3B (the converted MTFs plus the eight existing clinics), along with the totals for FY92 and FY97.

Under Case 3A, six additional MTFs are converted to clinics. However, while the hospital at Dover AFB is converted to a clinic under Case 3B, it is retained as a hospital under Case 3A. Table VI-12 shows the total cost of active-duty ambulatory clinics under Case 3A. This total is computed as the previous total for Case 3B, plus the cost of the six additional clinics, less the cost of the clinic at Dover AFB. All six additional clinics will still exist in FY97.

d. Total Cost of Active-Duty Medical Care

The total cost of active-duty medical care at MTFs and clinics is shown in Figure VI-13. The total ranges between $1.5 and $1.8 billion, depending on the exact case considered.

Table VI-11. Active-Duty Ambulatory Costs for Clinics, Case 3B, FY92 and FY97

S[a]	DMIS[b]	MTF	State	FY97[c]	Cost of Clinic Active-Duty Care
A	1	Redstone Arsenal	AL	x	3,995,356
A	2	Fort McClellan	AL	x	6,858,304
A	3	Fort Rucker	AL	x	6,063,493
A	5	Fort Wainwright	AK	x	5,856,355
A	8	Fort Huachuca	AZ	x	6,454,240
A	31	Denver	CO	x	7,645,111
A	32	Fort Carson	CO	x	16,031,509
A	47	Fort Gordon	GA	x	13,899,340
A	48	Fort Benning	GA	x	20,831,494
A	49	Fort Stewart	GA	x	14,838,016
A	57	Fort Riley	KS	x	12,837,085
A	58	Fort Leavenworth	KS	x	3,645,940
A	61	Fort Knox	KY	x	16,881,865
A	64	Fort Polk	LA	x	14,621,908
A	69	Fort Meade	MD	x	15,414,856
A	75	Fort Leonard Wood	MO	x	21,774,724
A	81	Fort Monmouth	NJ	x	5,322,433
A	86	West Point	NY	x	6,437,956
A	98	Fort Sill	OK	x	18,766,324
A	105	Fort Jackson	SC	x	17,069,200
A	108	Fort Bliss	TX	x	15,780,901
A	109	Fort Sam Houston	TX	x	12,830,806
A	121	Fort Eustis	VA	x	9,467,332
A	122	Fort Lee	VA	x	5,780,938
A	123	Fort Belvoir	VA	x	9,255,295
A	131	Fort Irwin	CA	x	5,316,361
A	330	Ft Drum*	NY	x	10,930,063
A	22	Presidio of San Francisco	CA		5,803,501
A	23	Fort Ord	CA		16,587,028
A	70	Fort Devens	MA		5,838,553
A	294	Fort Benjamin Harrison	IN		3,970,999
F	4	Maxwell AFB	AL	x	4,881,937
F	6	Elmendorf AFB	AK	x	7,729,912
F	9	Luke AFB	AZ	x	5,417,653
F	10	Davis Monthan AFB	AZ	x	5,344,996
F	13	Little Rock AFB	AR	x	4,061,044
F	14	Travis AFB	CA	x	6,850,369
F	15	Beale AFB	CA	x	3,043,363
F	16	McClellan AFB	CA	x	4,358,986
F	18	Vandenberg AFB	CA	x	4,113,415

Table VI-11. Active-Duty Ambulatory Costs for Clinics, Case 3B, FY92 and FY97 (Continued)

S[a]	DMIS[b]	MTF	State	FY97[c]	Cost of Clinic Active-Duty Care
F	19	Edwards AFB	CA	x	3,803,743
F	33	USAF Academy	CO	x	6,992,095
F	36	Dover AFB	DE	x	4,340,218
F	42	Eglin AFB	FL	x	10,258,831
F	43	Tyndall AFB	FL	x	3,759,514
F	45	Macdill AFB	FL	x	7,159,834
F	46	Patrick AFB	FL	x	2,834,569
F	50	Moody AFB	GA	x	3,045,088
F	51	Robins AFB	GA	x	3,516,703
F	53	Mountain Home AFB	ID	x	3,285,484
F	55	Scott AFB	IL	x	6,349,912
F	62	Barksdale AFB	LA	x	4,990,750
F	66	Andrews AFB	MD	x	10,375,786
F	73	Keesler AFB	MS	x	8,851,369
F	74	Columbus AFB	MS	x	2,393,659
F	76	Whiteman AFB	MO	x	3,325,849
F	77	Malmstrom AFB*	MT	x	3,710,869
F	78	Offutt AFB	NE	x	11,338,543
F	79	Nellis AFB	NV	x	5,518,807
F	82	McGuire AFB	NJ	x	6,676,834
F	83	Kirtland AFB	NM	x	4,328,626
F	84	Holloman AFB	NM	x	3,666,571
F	85	Cannon AFB	NM	x	4,011,295
F	90	Seymour Johnson AFB	NC	x	3,713,422
F	93	Grand Forks AFB	ND	x	3,912,625
F	94	Minot AFB	ND	x	3,972,379
F	95	Wright-Patterson AFB	OH	x	7,731,982
F	96	Tinker AFB	OK	x	5,528,467
F	97	Altus AFB	OK	x	3,066,616
F	101	Shaw AFB	SC	x	4,479,322
F	106	Ellsworth AFB	SD	x	4,386,517
F	111	Reese AFB	TX	x	2,195,767
F	112	Dyess AFB	TX	x	3,925,459
F	113	Sheppard AFB	TX	x	5,404,336
F	114	Laughlin AFB	TX	x	2,113,933
F	119	Hill AFB	UT	x	4,263,973
F	120	Langley AFB	VA	x	7,134,856
F	128	Fairchild AFB	WA	x	3,867,292
F	129	F.E. Warren AFB	WY	x	2,973,397
F	293	Grissom AFB*	IN	x	2,626,051

Table VI-11. Active-Duty Ambulatory Costs for Clinics, Case 3B, FY92 and FY97 (Continued)

S[a]	DMIS[b]	MTF	State	FY97[c]	Cost of Clinic Active-Duty Care
F	338	Vance AFB*	OK	x	2,093,095
F	364	Goodfellow AFB*	TX	x	2,826,358
F	17	Castle AFB	CA		4,322,830
F	21	March AFB	CA		6,426,295
F	54	Chanute AFB	IL		3,364,282
F	65	Loring AFB	ME		2,875,693
F	72	K.I.Sawyer AFB	MI		3,154,384
F	87	Plattsburgh AFB	NY		2,720,098
F	88	Griffiss AFB	NY		3,958,234
F	115	Bergstrom AFB	TX		3,481,720
F	116	Carswell AFB	TX		5,857,873
N	7	Adak	AK	x	2,751,444
N	24	Camp Pendleton	CA	x	22,591,956
N	26	Port Hueneme*	CA	x	5,896,154
N	28	Lemoore	CA	x	5,683,787
N	30	Twenty-nine Palms	CA	x	4,830,207
N	35	Groton	CT	x	8,382,123
N	38	Pensacola	FL	x	10,586,926
N	41	Key West*	FL	x	2,819,389
N	56	Great Lakes	IL	x	19,645,497
N	67	Bethesda	MD	x	18,844,582
N	68	Patuxent River	MD	x	3,591,217
N	92	Cherry Point	NC	x	6,063,147
N	100	Newport	RI	x	6,348,346
N	103	Charleston	SC	x	11,428,173
N	104	Beaufort	SC	x	15,847,397
N	107	Millington	TN	x	7,566,238
N	118	Corpus Christi	TX	x	4,270,048
N	126	Bremerton	WA	x	7,864,545
N	127	Oak Harbor	WA	x	5,516,251
N	297	New Orleans*	LA	x	3,345,110
N	25	Long Beach	CA		9,936,483
N	27	Oakland	CA		16,864,013
N	40	Orlando	FL		19,159,100
			FY92	Total	839,353,298
			FY97	Total	725,032,212

Notes: An asterisk (*) indicates existing clinics (vs. hospitals converted to clinics).

a Service codes: A=Army, F=Air Force, N=Navy.

b Defense Medical Information System (DMIS) identification number.

c "x" indicates clinic still open in FY97.

Table VI-12. Active-Duty Ambulatory Costs for Clinics, Case 3A, FY92 and FY97

S[a]	DMIS[b]	MTF	State	FY97[c]	Cost of Clinic Active-Duty Care
A	52	Tripler AMC	HI	x	20,664,997
A	80	Blanchfield ACH	KY	x	22,561,531
A	89	Womack ACH	NC	x	33,336,709
A	110	Darnell ACH	TX	x	22,893,145
N	39	NH Jacksonville	FL	x	15,506,212
N	91	NH Camp Lejeune	NC	x	16,834,393
		6 Additional Clinics in Case 3A		Subtotal	131,796,987
		Add Case 3B	FY92	Subtotal	839,353,298
			FY97	Subtotal	725,032,212
		Subtract Dover AFB			(4,340,218)
		Total Cost of Clinics, Case 3A	FY92		966,810,067
			FY97		852,488,981

a Service codes: A=Army, F=Air Force, N=Navy.
b Defense Medical Information System (DMIS) identification number.
c "X" indicates clinic still open in FY97.

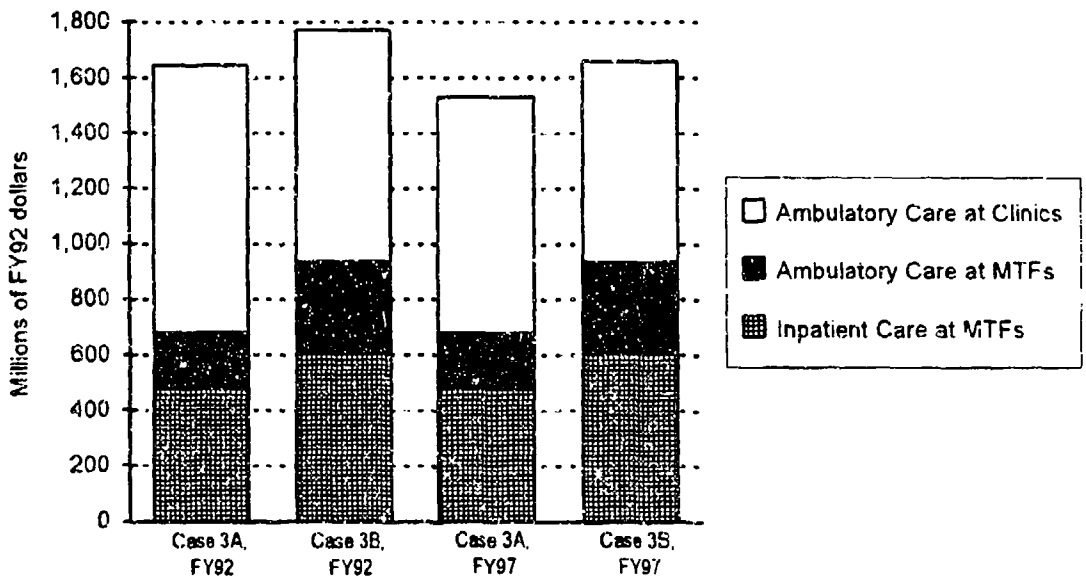

Figure VI-13. Total Cost of Active-Duty Medical Care, Case 3

C. ANALYTICAL CASE 4

1. Description of Case 4

Under Case 4, non-active-duty beneficiaries would have the choice of either enrolling in a military HMO to receive all of their medical care or enrolling in a civilian health plan and forfeiting any eligibility for care at MTFs. Case 4 is best described in the RAND publication:[13]

> The fourth case would offer most non-active-duty beneficiaries the choice of a military HMO plan based on the MTFs or one or more commercial health plans. All active-duty personnel would be enrolled in the military HMO if assigned to an MTF area; otherwise, they would receive care through small clinics as in the third case. MTFs would be responsible for all health care for beneficiaries who chose to enroll in the military plan, although some services would be provided by civilian providers at MTF expense. The MTFs' budgets for peacetime health-care delivery would be based on a per capita 'payment' for each enrollee.
>
> Non-active-duty beneficiaries who preferred civilian care would be offered one or more commercial plans (if possible, at least one HMO and one PPO and/or FFS plan). These beneficiaries would receive all of their care through the commercial plan they chose, and they would not be eligible for any care at the MTF. In areas where the military plan could not be offered, only commercial plans would be available. All beneficiaries would receive health care only within the plan they chose, with no health care provided outside the enrolled plan. CHAMPUS would be terminated.

The benefit packages in each case would be similar to those in existing plans. For example, the military HMOs would offer the same benefits as the HMO option under the CHAMPUS Reform Initiative (CRI) "Prime" program.[14] The FFS plans would offer the same benefits currently found in CHAMPUS. The civilian HMOs would offer the same benefits as the HMO option under the Federal Employees Health Benefits Plan (FEHBP). Finally, the list of military hospitals is the same under Case 4 as it was under Case 1.

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[13] "The Demand for Military Health Care: Supporting Research for a Comprehensive Study of the Military Health Care System."

[14] The CRI program is described in previously cited RAND publications: "Evaluation of the CHAMPUS Reform Initiative: Volume 2, Beneficiary Access and Satisfaction," and "Evaluation of the CHAMPUS Reform Initiative: Volume 3, Health Care Utilization and Costs."

Although MTFs would be reconfigured as HMOs, the sole mission of the military clinics would be to provide ambulatory care to active-duty personnel.

Note that non-active-duty beneficiaries currently receive care at MTFs on a space-available basis only. If they were to enroll in the military HMO, they would expect care on an expanded, entitlement basis rather than a space-available basis. Thus they would have little need to use CHAMPUS as a back-up when space is not available. This reasoning explains the termination of CHAMPUS under Case 4.

Premiums are an important aspect of the enrollment decision that non-active duty beneficiaries make between the military HMO and civilian plans. In fact, DoD could use premiums to regulate the enrollment decision, thereby assuring sufficient enrollment in the military HMO to fill MTF capacity. In an effort to calibrate the enrollment decision, RAND considered three premium structures:

- **Case 4A**: Equal premiums for all plans;
- **Case 4B**: Premiums for civilian plans that exceed those for the MTF plan by $20 per month for individuals and $50 per month for families; and
- **Case 4C**: Premiums for civilian plans that exceed those for the MTF plan by $30 per month for individuals and $75 per month for families.

Table VI-13 summarizes the percentage of beneficiaries who choose the MTF plan under each premium structure. When the premiums are equal for all plans, RAND predicts that only a minority of non-active-duty beneficiaries will select the military plan. However, about two-thirds of these beneficiaries select the military plan at a cost advantage of $20 per month (or $50 per month for families), and over three-quarters select the military plan when the cost advantage rises further to $30 per month (or $75 per month for families). According to RAND projections, Case 4B yields a total of 6.2 million beneficiaries, including all active-duty personnel residing in MTF catchment areas. We will see that this case most closely approximates the current situation, enabling the existing set of MTFs to remain open and operate at somewhat more intense utilization levels.

2. Cost Estimates for Case 4

Table VI-14 summarizes the RAND predictions of workload under Cases 4A through 4C; the Case 1 workloads are also repeated here as a basis of comparison. As was asserted earlier, the premium advantage under Case 4B yields MTF workloads most closely approximating historical levels. The total number of CMA dispositions is 20.8%

higher in Case 4B than in Case 1, and the total number of ambulatory visits is within 0.7%. Although the total number of visits is extremely close, there is a geographical redistribution of visits among MTFs under Case 4B. Specifically, the Case 4B visits differ from the Case 1 visits by more than ±10% for some 27% of all MTFs.

Table VI-13. Percentage of Beneficiaries Choosing Military HMO Plan

Military HMO Plan: Monthly Premium Advantage		Percentage of Beneficiaries Choosing Military HMO Plan			
Individuals	Families	Active-Duty Dependents	Retirees Under Age 65	Retirees Age 65 and Over	Total Enrollment (Millions)
$0	$0	27%	30%	40%	3.7
$20	$50	68%	70%	66%	6.2
$30	$75	82%	86%	78%	7.2

Source: RAND Corporation. Note that total enrollment includes all active-duty personnel residing within catchment areas.

Table VI-14. Workload Summary for Case 4

	Case 1	Case 4A	Case 4B	Case 4C
Inpatient Case-Mix Adjusted Dispositions:				
Number (thousands)	637.3	486.8	769.8	871.9
% increase over Case 1	N/A	-23.6%	20.8%	36.8%
Ambulatory Visits:				
Number (millions)	38.01	25.65	38.26	42.64
% increase over Case 1	N/A	-32.5%	0.7%	12.2%

Source: Tabulations from spreadsheets provided by the RAND Corporation.

The detailed cost estimates are shown in Table VI-15, and a summary is displayed in Figure VI-14. The "MEPRS FY92 Reported" column in the table again shows reported inpatient and ambulatory costs for FY92. The "MEPRS FY92 Adjusted" column represents an application of the MEPRS adjustment factors developed in Chapter III (Figure III-7), and gives a more accurate and comprehensive estimate of historical costs.

Table VI-15. Cost Breakout for Case 4
(Millions of FY92 Dollars)

		MEPRS FY92 Reported	MEPRS FY92 Adjusted	Case 4	Case 4B	Case 4C
Inpatient						
Army	Medical Center	688.4	799.9	726.3	986.5	1,081.1
	Hospital	393.7	457.5	394.7	522.1	564.0
Air Force	Medical Center	383.7	432.5	386.1	520.6	569.6
	Hospital	335.7	378.3	302.7	421.5	462.5
Navy	Medical Center	373.4	420.8	361.2	476.8	518.6
	Hospital	236.8	266.9	253.3	319.4	341.6
Inpatient Total		2,411.7	2,755.9	2,424.3	3,247.0	3,537.4
Ambulatory						
Army	Medical Center	527.9	593.9	487.2	572.6	598.9
	Hospital	696.6	783.7	591.5	774.6	829.6
	Clinic	19.0	21.4	11.4	11.4	11.4
Air Force	Medical Center	295.8	326.9	258.7	301.8	316.3
	Hospital	658.9	728.1	460.3	732.8	823.8
	Clinic	98.1	108.3	79.1	102.7	110.6
Navy	Medical Center	362.4	400.8	298.8	341.1	356.0
	Hospital	457.7	506.2	404.4	545.2	586.0
	Clinic	81.7	99.4	72.6	82.3	85.3
Ambulatory Total		3,198.1	3,559.6	2,664.1	3,464.3	3,717.9
Total Cost		5,609.8	6,315.5	5,088.4	6,711.3	7,255.3

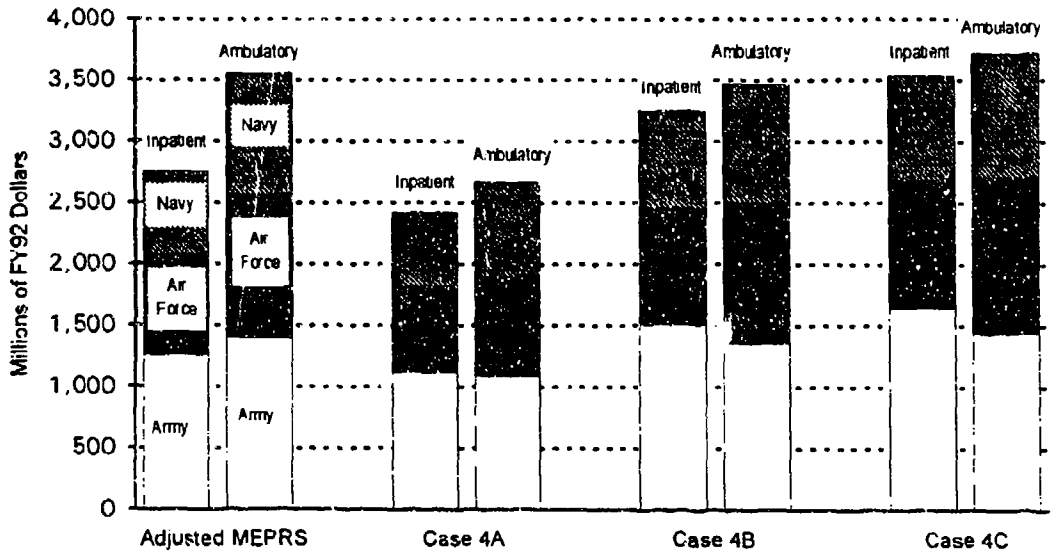

Figure VI-14. Cost Breakout for Case 4

Both workload and cost increase as we move from Case 4A to Case 4B, and again from Case 4B to Case 4C. This result reflects the widening premium advantage that the MTF system enjoys in the latter cases, enticing more DoD beneficiaries to enroll in the MTF plan. Compared to the adjusted MEPRS data, total in-house cost is 19.4% lower under Case 4A, but 6.3% higher under Case 4B and 14.9% higher under Case 4C. Of course, computation of the net change in total cost requires an estimate of the corresponding reduction in the cost of civilian health plans purchased for DoD beneficiaries. Estimates of civilian health-plan cost are found in the RAND publication.

D. SUMMARY OF ANALYTICAL CASES

This chapter has presented both descriptions and estimates of in-house cost under four analytical cases and numerous subcases. As mentioned in several places, the cost estimates are incomplete unless paired with the corresponding RAND estimates of civilian-sector costs borne by DoD. Integration of the IDA and RAND cost estimates has been performed by OD(PA&E).[15] The PA&E report also discusses the assignment of responsibility for the employer share of health costs, and the related issue of DoD collection of payments from third-party insurers. Those important issues involve the shifting of cost among various parties, but do not affect the *total* MTF costs that must be borne by all parties collectively. The estimates of total MTF cost presented in this chapter depend only upon the hospital workloads and capacities as specified in the various analytical cases.

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15 "The Economics of Sizing the Military Medical Establishment: Executive Report of the Comprehensive Study of the Military Health Care System"

VII. CONCLUSIONS AND AGENDA FOR FUTURE RESEARCH

A. PEACETIME SPENDING ON MILITARY MEDICAL CARE

This paper presents our estimates of both total peacetime expenditure on military medical care, and the portion of the total spent maintaining the resources required for wartime. Existing estimates of total spending were based on identifying program elements in the FYDP whose titles and descriptions suggest at least a partially medical mission. We were able to improve upon existing estimates, mostly by identifying additional medical personnel scattered throughout program elements with primary missions other than medical.

We isolated additional medical personnel by using data on personnel assignments provided by the Defense Manpower Data Center (DMDC). However, the Army does not report program element in its data submissions to DMDC. We therefore inferred the locations of Army medical personnel using personnel *authorizations* (not assignments) obtained from the U.S. Army Force Integration Support Agency. Moreover, we encountered about 3,000 individuals whose Army Management Structure codes could not be successfully mapped into program elements. Because of these difficulties, our estimate of total medical expenditure for the Army is less precise than our corresponding estimates for the Navy and the Air Force. Additional research would be desirable to improve our accounting of medical personnel in the Army.

We also attributed a portion of total peacetime spending to maintaining the resources required for wartime. We estimated the cost of the casualty-based requirement by assuming that these physicians practice medicine in CONUS MTFs during peacetime. That approach tends to overstate the peacetime cost, by burdening the physician with the costs of other medical personnel, as well as the non-salary costs of materials, supplies, and capital equipment associated with peacetime medical care. A physician serving, for example, on a headquarters staff would not generate these additional peacetime costs. Unfortunately, it is nearly impossible to determine the exact identities and peacetime activities of the physicians who would be called upon to provide casualty care in the theater or in CONUS in the event of war.

The cost of the wartime structural requirement was estimated by further refining the list of program elements used to construct the peacetime medical total. We retained medical personnel associated in peacetime with combat units, combat-support units, and management headquarters in operational commands; we excluded medical personnel associated with peacetime training, administration, research and development, and Service headquarters. We made the latter exclusions because we were unable to isolate the *wartime* components of the corresponding program elements. However, further consultation with the Services may facilitate a finer partitioning of these ambiguous program elements into their wartime and peacetime components, enabling us to improve our estimate of the wartime structural requirement. This, too, remains a fertile area for additional research.

B. REGRESSION MODELING OF MTF COST

This paper has used MEPRS data to model the relationship between cost and workload at military hospitals. Prior to estimating the models, we adjusted the MEPRS data to include the same set of cost elements that would be reflected in the prices charged by civilian-sector providers. These adjustments ranged between 10.6% and 16.9%, depending on the Service branch and the type of care (i.e., inpatient or ambulatory).

In developing the adjustment factors, we concluded that the Service comptroller pay factors used in MEPRS are too low for physicians, but too high for nurses, medical service corps officers, and medical enlisted personnel. Although these errors average out to zero in the aggregate, they impart a bias in the relative costs of the various categories of personnel. For certain purposes, such as determining the least-cost mix of personnel by category, it would be preferable to use the medical-specific pay factors developed in this paper. Further research may be desirable to assess the impact of using alternative pay factors in making decisions on staffing mix.

We developed regression models to predict cost as a function of the inpatient and ambulatory workloads, the number of operating beds, and the level of graduate medical education (GME) provided at each MTF. The facility-level costs can then be summed to predict the system-wide costs of in-house medical care. Corresponding cost estimates for care provided in the civilian sector have been prepared by the RAND Corporation.

Several difficulties were encountered in developing the regression models. Foremost, inpatient discharges were case-mix adjusted using CHAMPUS Version 8 DRG weights. This procedure was necessary to account for the differences across clinical areas

in resource intensity. The use of DRG weights enabled us to form a homogeneous work unit for inpatient care at each MTF. Moreover, the case-mix adjustment enabled us to combine data from medical centers with data from community hospitals. These two sources of data would have been incommensurable without a case-mix adjustment, because community hospitals refer many of their most difficult cases to medical centers.

By using CHAMPUS DRG weights, we assumed that the relative cost by DRG based on CHAMPUS experience provides a good predictor of the relative cost by DRG in military hospitals. Further research may be necessary to investigate the validity of this assumption, and to explore alternative methods of case-mix adjustment. Additional research may also be required to develop corresponding measures of resource intensity for ambulatory care.

Another difficulty involved correcting for the escalation in unit cost observed at MTFs between FY90 and FY92. The two-year cumulative escalation rates ranged between 15.2% and 27.3%, depending on the type of facility (i.e., medical center, community hospital, or ambulatory clinic) and the type of care (i.e., inpatient or ambulatory). These escalation rates cannot be strictly interpreted as price indices for medical care, because rapid technological advance invalidates the concept of comparing prices for a constant set of goods or services. Some of the FY92 outlays may represent the spend-out of FY91 obligations made in connection with Operation Desert Storm. Notwithstanding this possible explanation, the escalation rates are high enough to merit further investigation.

We estimated the costs associated with GME programs at military hospitals. Our estimates included student salaries, as recorded both directly in classroom time and indirectly in patient-care time. Our estimates also included instructor salaries, plus some miscellaneous expenses incurred at teaching hospitals such as medical library, medical illustration, and medical photography. We found that each additional enrolled resident or intern adds nearly $170,000 in total to these elements of hospital cost. More research would be desirable to both improve the accounting of GME costs at military hospitals, and to assess the cost-effectiveness of military GME programs.

In developing the regression models, we encountered difficulties in comparing cost and workload data across the three Services. In particular, unit cost as computed from MEPRS data appeared to be higher for the Navy than for the Army or the Air Force. Insight into this result was provided by examining the ratios between workload as reported in MEPRS, and workload as estimated from the 1992 DoD Health Care Survey. More

workload is reported in MEPRS than in the survey, but the difference is less pronounced for the Navy than for the other two Services. Thus, MEPRS may understate Navy workload (or overstate it less), fostering the appearance of higher unit cost for the Navy. Although MEPRS purports to be a standardized accounting system, further research may be warranted to improve the comparability of data across the Services.

The ratios between MEPRS-based and survey-based workload were also important in the interaction between the IDA and RAND elements of the Section 733 Study. RAND projected hypothetical inpatient and ambulatory workloads under four analytical cases. The RAND projections were based on models calibrated from the 1992 DoD Health Care Survey. The IDA cost models, however, were estimated from MEPRS data on cost and workload. A conversion was necessary to make the RAND workloads fit into the IDA cost models. The conversion factors, or "exchange rates," were computed by RAND along various dimensions such as inpatient versus ambulatory care, beneficiary category, and Service branch. Additional research may be justified to improve the process of combining accounting-system data with self-reported survey data.

C. COST PROJECTIONS FOR THE ANALYTICAL CASES

The IDA and RAND cost projections may be combined to assess the overall cost-effectiveness of expanding, contracting, or otherwise restructuring the military health-care system. A critical assumption is that the exchange rates are valid for extrapolation, so that the historical relationships between the two workload measurement systems continue to apply throughout the analytical cases. These relationships are likely to change in the future, as capitation-based budgeting removes some of the incentive to overstate workload. Subsequent studies should revisit the exchange rates, rather than simply applying the same exchange rates that were estimated from FY92 data.

The IDA and RAND cost projections do not correspond to the entirety of medical expenditures funded through Major Force Program 8 (Training, Medical, and Other General Personnel Activities) of the FYDP. It is not possible to completely reconcile the cost projections with the FYDP, because there is no crosswalk between MEPRS expense categories and program elements in the FYDP. However, certain program elements were deliberately excluded from the cost projections. For example, the Uniformed Services University of the Health Sciences (USUHS) and the Armed Forces Scholarship Program (AFSP) were not analyzed, because the funding for these activities would not necessarily

move in proportion to changes in MTF workload under the analytical cases. Any changes in funding for these activities should be calculated independently of the respective IDA and RAND cost estimates for in-house and civilian-sector medical care. The calculated funding levels should then be added back to the sum of the IDA and RAND cost estimates, thereby rounding-out the cost estimate for Major Force Program 8.

Also excluded were two large program elements for Education and Training, Health Care ($900 million in FY92), and Other Health Activities ($1 billion in FY92). In the former case, much of the funding for medical training is already demonstrable in MEPRS, and much of the remainder may already be embedded in MEPRS albeit less visibly. Moreover, as was the case for USUHS and AFSP, a large portion of medical training costs may be "fixed" rather than "variable," thus independent of the level of MTF workload. To the extent that costs are fixed, they cancel out in the comparison between the various analytical cases.

In the second instance, the program element for Other Health Activities funds many activities more closely related to DoD's wartime readiness mission than to its peacetime care mission. We were unable to partition this program element into its wartime and peacetime components for the current study. However, a more concerted effort to do so in the future might prove worthwhile.

Finally, the cost structure at MTFs is likely to change as capitation-based budgeting, managed care, and other initiatives become more pervasive. The third and fourth analytical cases introduce many of these elements, yet the cost functions are based on historical experience from which these elements are largely absent. Although we attempted to adjust our estimates to reflect these factors, future studies should recalibrate the cost functions to ensure that they are consistent with the emerging experience.

APPENDIX A
MEDICAL PROGRAM ELEMENTS

APPENDIX A
MEDICAL PROGRAM ELEMENTS

The tables in this appendix list the Program Elements (PEs) whose costs contributed to the estimate of total peacetime cost in Chapter II of the text. Tables A-1, A-2 and A-3 deal with the Army, Navy and Marine Corp, and Air Force, respectively. Three types of PEs are listed in each table. The "COMA, Fully Medical" PEs are those PEs dedicated to medical care and whose full FYDP costs were included in the estimate of peacetime cost by both the COMA and the present study. For the "COMA, Partially Medical" PEs, only part of the total FYDP costs for the PE were included. (The COMA study did not use the terms "fully medical" and "partially medical", distinguishing between PEs; the terms are ours.) The "Non-COMA" PEs are those that contain the "additional medical personnel" whose costs were not included by the COMA study (see the discussion in Chapter II).

Tables A-1 through A-3 also list the medical personnel in each PE. As explained in Chapter II, the Navy and Air Force personnel were identified from the personnel database maintained by the Defense Manpower Data Center (DMDC). The Army figures were obtained from the Force Integration Support Agency (FISA). A few PEs were included because they contain small numbers of civilian medical personnel, even though they might not contain any military medical personnel. The numbers of civilian medical personnel are not shown in the tables.

Note that the medical personnel in the three types of PE contribute different shares to total medical cost. For the COMA, Fully Medical PEs, we included the Military Personnel (MilPers) costs of *all* personnel in the PE, plus the other, non-personnel costs listed in the FYDP. It is only the *medical* personnel listed in the tables (those with a medical Military Occupational Specialty) whose pay was adjusted. Some non-personnel costs were also included for the COMA, Partially Medical PEs, along with the pay-adjusted MilPers costs of the medical personnel. (The COMA study does not provide detail on the contributions of medical personnel, other personnel, and non-personnel costs to that study's estimate of total medical cost.) For the Non-COMA PEs, it is *only* the pay-adjusted MilPers costs of the medical personnel listed in the tables that were included in total peacetime medical cost.

Table A-1. Army Medical Program Elements

	PE	Title	FISA Active-Duty Medical Personnel		
			Officer	Enlisted	Total
COMA, Fully Medical	0202017A	Tactical Support - Medical Units	517	4,269	4,786
	0301311A	Armed Forces Medical Intelligence Center	7	0	7
	0508997A	Medical Support Units (Army Reserve)	0	0	0
	0602787A	Medical Technology	426	761	1,187
	0603002A	Medical Advanced Technology	0	0	0
	0603105A	Military HIV Research	0	0	0
	0603807A	Medical Systems Advanced Development	20	0	20
	0806722A	Armed Forces Health Professions Scholarship Pgm	0	0	0
	0806761A	Education and Training - Health Care	516	1,054	1,570
	0807711A	Care in Regional Defense Facilities	4,158	4,920	9,078
	0807712A	CHAMPUS	0	0	0
	0807713A	Care in Non-Defense Facilities	0	0	0
	0807714A	Other Health Activities	1,109	3,096	4,205
	0807715A	Dental Care Activities	1,332	2,051	3,383
	0807790A	Visual Information Activities - Medical	1	0	1
	0807792A	Station Hospitals & Medical Clinics	4,710	8,932	1,3642
	0807794A	RPMA - Health Care	0	0	0
	0807795A	Base Communications - Health Care	0	0	0
	0807796A	Base Ops - Health Care	10	6	16
	0807798A	Mgt HQ - Health Care	128	21	149
	0808617A	Publications, Print, Repro HSC	0	0	0
	0808618A	Records Mgt and Mail Room HSC	0	0	0
	0809712A	Service Support to USUHS	48	49	97
COMA, Partially Medical	0601101A	In-House Lab Independent Research	0	0	0
	0601102A	Defense Research Sciences	0	0	0
	0605801A	Programwide Activities	3	1	4
	0605898A	Mgt HQ - R&D	45	1	46
	0801713A	Examining Activities	9	149	158
	0808611A	Info Program Management	0	0	0
	0808612A	Info Mgt - Program 8 Pers	0	0	0
	0808615A	Auto Acq Mgt & Spt: Product/Pgm/Proj	18	19	37
	0808616A	Info Mgt - Central Software Design - Program 8	1	5	6
	0902398A	Mgt HQ - Departmental	66	1	67

Table A-1. Army Medical Program Elements (Continued)

	PE	Title	FISA Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA	0201113A	US European Command (USEUCOM) Activities	0	1	1
	0201298A	Mgt HQ - LANTCOM	1	0	1
	0201398A	Mgt HQ - USEUCOM	3	0	3
	0201598A	Mgt HQ - SOUTHCOM	4	0	4
	0201898A	Mgt HQ - US Central Command	3	0	3
	0202011A	Divisions	1,010	9,037	10,047
	0202012A	Non-Divisional Combat Brigades/Regiments	90	1,004	1,094
	0202013A	Other Non-Divisional Combat Units	54	717	771
	0202014A	Tactical Support - Other Units	37	189	226
	0202016A	Tactical Support - Intelligence Units	5	23	28
	0202018A	Tactical Support - Logistics Units	47	175	222
	0202019A	Tactical Support - Administrative Units	1	63	64
	0202020A	Tact Support-Maint of Tact Equip	4	16	20
	0202081A	Theater Air Defense Forces	2	7	9
	0202082A	Theater Missile Forces (H)	6	118	124
	0202085A	Theater Defense Forces	27	245	272
	0202091A	Intelligence Support	3	15	18
	0202092A	Special Activities	0	33	33
	0202093A	Force-Related Training	2	11	13
	0202096A	Base Ops	1	53	54
	0202098A	Mgt HQ	11	2	13
	0202099A	Administrative Support	5	21	26
	0208013A	Special Ammunition Control - Non-US	0	1	1
	0208015A	Combat Developments	10	8	18
	0208018A	Other Combat Development Activities	50	4	54
	0208198A	Mgt HQ - Concepts Analysis Agency	1	0	1
	0301011A	Cryptologic Activities	0	1	1
	0301198A	Mgt HQ - Cryptologic	1	0	1
	0303111A	Strategic Army Communications - STARCOM	0	1	1
	0303126A	Long-Haul Communications - DCS	0	13	13
	0303196A	Base Ops - Communications	0	6	6
	0308610A	Info Mgt - Automation - Program 3	12	0	12
	0502924A	Tactical Support Forces - Nonaffiliated - Army Reserve (H)	0	3	3
	0508991A	Recruiting Activities - Army Reserve	3	0	3
	0509898A	Mgt HQ - Army Reserve National Guard	2	0	2

Table A-1. Army Medical Program Elements (Continued)

	PE	Title	FISA Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0509992A	Reserve Readiness Support - Army Reserve	90	147	237
	0509993A	Personnel Administration - AR	2	0	2
	0509998A	Mgt HQ - Army Reserve	15	3	18
	0602211A	Aviation Technology	1	0	1
	0602622A	Chemical and Smoke Munitions	2	21	23
	0602716A	Human Factors Engineering in System Development	3	1	4
	0602786A	Logistics Technology	9	15	24
	0605601A	Army Test Ranges and Facilities	1	17	18
	0605712A	Support of Operational Testing	0	2	2
	0605896A	Base Ops - RDT&E	0	3	3
	0702829A	Logistics Administrative Support	3	0	3
	0702891A	Commissary Retail Sales	1	0	1
	0702894A	RPMA - Logistics	1	0	1
	0702896A	Base Ops - Logistics	1	2	3
	0702898A	Mgt HQ - Logistics	12	1	13
	0708012A	Logistics Support Activities	1	1	2
	0708110A	Service Support to DLA	18	1	19
	0801711A	Recruiting Activities	25	139	164
	0801798A	Mgt HQ - USAREC	3	0	3
	0804711A	Recruit Training Units	0	65	65
	0804721A	Service Academies	7	3	10
	0804723A	Reserve Officers Training Corps (ROTC)	12	0	12
	0804731A	General Skill Training	6	12	18
	0804741A	Undergraduate Pilot Training (UPT)	1	0	1
	0804751A	Professional Military Education	8	3	11
	0804761A	Integrated Recruit & Skill Training Units	0	6	6
	0804771A	Support of the Training Establishment	1	32	33
	0804772A	Training Developments	2	0	2
	0805794A	RPMA - Training	0	0	0
	0805796A	Base Ops - Training	0	9	9
	0805798A	Mgt HQ (Training)	7	1	8
	0805896A	Base Ops - Service Academies	0	1	1
	0808610A	Info Mgt - Automation - Program 8	64	0	64
	0808716A	Other Personnel Activities	15	30	45
	0808751A	Civilian Training, Education, & Development	0	0	0
	0809703A	Service Support to OSD	8	1	9
	0809731A	Training Support to Units	8	31	39

Table A-1. Army Medical Program Elements (Continued)

	PE	Title	FISA Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0901212A	Service-Wide Support	23	1	24
	0901220A	Personnel Administration	42	12	54
	0901518A	Service Support to Non-DoD Activities (Non-Reim)	4	0	4
	0902498A	Mgt HQ - Administrative	1	0	1
	1001098A	Mgt HQ - International	1	0	1
	1108048A	Service Support to Special Operations Forces	1	0	1
Not elsewhere classified		In FISA personnel database, but without known PE	658	2,690	3,348
		In DMDC, but not FISA personnel database	2,660	762	3,422
Total			18,236	41,114	59,350

Table A-2. Navy Medical Program Elements

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
COMA, Fully Medical	0508131N	Care in Defense Facilities	0	0	0
	0508136N	Health Activities	0	0	0
	0508137N	Dental Care Activities	0	0	0
	0508792N	Station Hospitals & Medical Clinics	0	0	0
	0508798N	Mgt HQ - Health Care	0	0	0
	0603216N	Aviation Life Support Systems (Adv)	0	0	0
	0603706N	Medical Development	0	0	0
	0604771N	Medical Developments	0	0	0
	0806722N	Armed Forces Health Professions Scholarship Pgm	0	0	0
	0806761N	Education and Training - Health Care	730	2,623	3,353
	0807711N	Care in Regional Defense Facilities	2,964	4,283	7,247
	0807712N	CHAMPUS	0	0	0
	0807713N	Care in Non-Defense Facilities	0	0	0
	0807714N	Other Health Activities	336	482	818
	0807715N	Dental Care Activities	1,110	2,077	3,187
	0807790N	Visual Information Activities - Medical	0	0	0
	0807792N	Station Hospitals & Medical Clinics	4,208	11,154	15,362
	0807794N	RPMA - Health Care	0	0	0
	0807795N	Base Communications - Health Care	0	0	0
	0807796N	Base Ops - Health Care	0	0	0
	0807798N	Mgt HQ - Health Care	135	72	207
	0809712N	Service Support to USUHS	62	48	110
COMA, Partially Medical	0408036N	Sealift Enhancement - Surge	11	40	51
	0505096N	Base Ops - Other Naval Reserve	13	390	403
	0508112N	Professional and Skill Progression Training - NR	0	0	0
	0509498N	Mgt HQ (Departmental Naval Reserve)	1	0	1
	0509598N	Mgt HQ - Field Naval Reserve	1	9	10
	0701113N	Procurement Operations	7	12	19

Table A-2. Navy Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA	0101221N	Fleet Ballistic Missile System	0	53	53
	0101222N	Support Ships - FBMS	26	92	118
	0101228N	Trident I	5	37	42
	0101315N	FBM Control System - Communications	2	1	3
	0101830N	Operational HQ - Offensive	6	11	17
	0101896N	Base Ops - Offensive	30	73	103
	0201113N	US European Command - USEUCOM Activities	1	1	2
	0201298N	Mgt HQ - LANTCON	1	0	1
	0201398N	Mgt HQ - USEUCOM	1	0	1
	0201498N	Mgt HQ - PACOM	3	1	4
	0201898N	Mgt HQ - US Central Command	1	1	2
	0202698N	Mgt HQ - FORSCOM	5	0	5
	0204112N	Multi-Purpose Aircraft Carriers	157	640	797
	0204134N	A-6 Squadrons	0	15	15
	0204135N	A-7 Squadrons	0	6	6
	0204136N	F/A-18 Squadrons	0	19	19
	0204144N	F-14 Squadrons	0	22	22
	0204151N	COD Squadrons	1	0	1
	0204152N	E-2 Squadrons	0	13	13
	0204154N	Sea-Based Electronic Warfare Squadrons	0	14	14
	0204155N	Shore-Based Electronic Warfare Squadrons	3	7	10
	0204156N	Readiness Squadrons	12	27	39
	0204220N	Battleships	12	79	91
	0204221N	Cruisers	9	130	139
	0204222N	Destroyers - Missile	0	58	58
	0204223N	Destroyers - Non-Missile	2	86	88
	0204224N	Frigates - Missile	0	71	71
	0204225N	Frigates - Non-Missile	0	75	75
	0204226N	Patrol Combatants	0	2	2
	0204227N	Support Forces	62	209	271
	0204233N	SH-3 Squadrons	0	14	14
	0204234N	S-3 Squadrons	0	12	12
	0204251N	ASW Patrol Squadrons	17	64	81
	0204262N	Readiness Squadrons - ASW	12	42	54
	0204281N	Submarines	0	106	106
	0204282N	Support Forces	52	209	261
	0204302N	Mine Countermeasure Forces	0	10	10

Table A-2. Navy Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0204303N	Air Mine Countermeasures Squadrons	2	4	6
	0204311N	Undersea Surveillance Systems	0	2	2
	0204411N	Amphibious Assault Ships	77	546	623
	0204412N	Amphibious Support Ships	5	20	25
	0204413N	Amphibious Tactical Support Units (Displacement)	1	25	26
	0204424N	Explosive Ordnance Disposal Forces	3	15	18
	0204441N	Underway Replenishment Ships	30	157	187
	0204451N	Major Fleet Support Ships	11	30	41
	0204452N	Minor Fleet Support Ships	0	26	26
	0204453N	Direct Support Squadrons - Aircraft	8	34	42
	0204454N	Special Combat Support Forces	1	6	7
	0204455N	Naval Construction Forces	15	86	101
	0204457N	Shore Intermediate Maintenance Activities	2	5	7
	0204561N	Deep Submergence Systems	0	15	15
	0204577N	Relocatable Over-the-Horizon Radar (ROTHR)	0	2	2
	0204633N	Fleet Support Training	1	17	18
	0204651N	Operational HQ - Fleet	3	3	6
	0204652N	Operational HQ - Sea Control/Projection	34	1	35
	0204654N	Operational HQ - Sea Control/Air	7	0	7
	0204655N	Operational HQ - Sea Control/Surface)	18	48	66
	0204656N	Operational HQ - Sea Control/Subsurface	20	30	50
	0204696N	Base Ops - Naval Air Bases	11	53	64
	0204698N	Mgt HQ - Fleet	15	9	24
	0204796N	Base Ops - Fleet Support Surface	38	120	158
	0204798N	Mgt HQ - Sea Control/Projection	6	2	8
	0204896N	Base Ops - Fleet Support Subsurface	1	1	2
	0204898N	Mgt HQ - Surface	4	12	16
	0204996N	Base Ops - Fleet Logistics Support	2	7	9

Table A-2. Navy Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0204998N	Mgt HQ - Subsurface	2	2	4
	0205096N	Base Ops - Other Base Support	6	24	30
	0206125M	Helicopter Combat Support - MAW	13	36	49
	0206126M	Tactical Combat Support MAW	75	317	392
	0206211M	Divisions Marine	126	2,069	2,195
	0206315M	Force Service Support Group (FSSG)	289	1,699	1,988
	0206496M	Base Ops - Forces - Marine Corps	11	27	38
	0206497M	Training - Marine	0	2	2
	0206498M	Mgt HQ - Fleet Marine Force	9	12	21
	0208015N	Combat Developments	3	0	3
	0301011N	Cryptologic Activities	0	6	6
	0301309N	Intelligence Support Center	3	1	4
	0303113N	Navy Communications (NAVCOM)	6	15	21
	0304112N	Special Collection	1	4	5
	0305128N	Security/Investigative Activities	1	0	1
	0305131N	Mapping, Charting, and Geodesy	0	6	6
	0305805N	Service Support to NSA (NFIP)	1	4	5
	0305806N	Service Support to DNA	1	0	1
	0402167N	MSC Area HQ	3	12	15
	0408098N	Mgt HQ - USTRANSCOM	2	0	2
	0502312N	A-6 Squadrons	0	4	4
	0502313N	A-7 Squadrons	0	2	2
	0502319N	F-14 Squadrons	0	4	4
	0502332N	SH-3 Squadrons	0	4	4
	0502338N	LAMPS	0	6	6
	0502341N	ASW Patrol Squadrons	0	28	28
	0502351N	Frigates - Missile	0	49	49
	0502352N	Frigates - Non-Missile	0	28	28
	0502359N	Mine Countermeasures Forces	0	16	16
	0502360N	Air Mine Countermeasure Squadrons	0	4	4
	0502366N	Amphibious Assault Ships	0	9	9
	0502372N	Inshore Undersea Warfare Forces	0	2	2
	0502374N	Explosive Ordnance Disposal Forces	0	4	4

Table A-2. Navy Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0502378N	Minor Fleet Support Ships	0	13	13
	0502379N	Direct Support Squadrons	0	2	2
	0502380N	Special Combat Support - Cargo Handling	0	2	2
	0502384N	Naval Construction Forces	0	6	6
	0502385N	Shore Intermediate Maintenance Activities	0	7	7
	0502425N	Operational HQ - Sea Control/Surface	2	8	10
	0502514M	Force Service Support Group - MCR	11	105	116
	0505196N	Base Ops - Reserve Airbases	5	446	451
	0508711N	Recruiting Activities -NR	0	105	105
	0509520N	Reserve Readiness Support - NR	17	103	120
	0605001N	R&D Laboratories - IF	21	38	59
	0605851N	Facilities and Installation Support	145	174	319
	0605863N	RDT&E Ship and Aircraft Support	0	2	2
	0605898N	Mgt HQ - R&D	17	3	20
	0605904N	Service Support to DARPA	1	0	1
	0605906N	Service Support to DNA	14	9	23
	0701111N	Supply Depot Operations - Non-IF	3	3	6
	0701112N	Inventory Control Point Operations	0	5	5
	0702028N	Ship Maintenance Activities - IF	4	1	5
	0702031N	Naval Ordnance Activities - IF	1	4	5
	0702896M	Base Ops - Logistics	2	18	20
	0702896N	Base Ops - Logistics	0	3	3
	0702898N	Mgt HQ - Logistics	1	0	1
	0708012N	Logistics Support Activities	14	8	22
	0708017N	Maintenance Support Activities	1	6	7
	0708020N	information Automation	1	1	2
	0708110N	Service Support to DLA	6	0	6
	0801711M	Recruiting Activities	0	57	57
	0801711N	Recruiting Activities	98	82	180
	0801713N	Examining Activities	5	104	109
	0804711M	Recruit Training Units	0	5	5

Table A-2. Navy Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA	0804711N	Recruit Training Units	0	30	30
(Continued)	0804721N	Service Academies	8	5	13
	0804722N	Officer Candidate/Training Schools (OCS/OTS)	0	1	1
	0804723N	Reserve Officers Training Corps (ROTC)	0	5	5
	0804724N	Other College Commissioning Programs	0	50	50
	0804731M	General Skill Training	10	43	53
	0804731N	General Skill Training	231	144	375
	0804733N	General Intelligence Skill Training	0	1	1
	0804734N	Crypto/SIGINT-Related Skill Training	0	2	2
	0804742N	Undergraduate Navigator/NFO Training (UNT)	4	0	4
	0804743N	Other Flight Training	5	27	32
	0804745N	Undergraduate Pilot Training (UPT) - Strike	8	14	22
	0804746N	Undergraduate Pilot Training (UPT) - Maritime	2	0	2
	0804751M	Professional Military Education	7	6	13
	0804751N	Professional Military Education	9	7	16
	0804752N	Other Professional Education	27	0	27
	0804772N	Training Developments	1	0	1
	0805796N	Base Ops - Training	4	21	25
	0805798N	Mgt HQ (Training)	4	0	4
	0808716N	Other Personnel Activities	16	39	55
	0808796N	Base Ops - Other General Personnel Activities	0	15	15
	0809703N	Service Support to OSD	11	0	11
	0809731M	Training Support to Units	1	2	3
	0809731N	Training Support to Units	4	2	6
	0901232N	Service-Wide Support - Not Otherwise Accounted For	34	8	42
	0901220N	Personnel Administration	42	39	81
	0901296N	Base Ops - Administrative	0	5	5
	0901503N	Service Support to OSD	12	0	12
	0901507N	Service Support to JCS	4	0	4
	0901518N	Service Support to Non-DoD Activities - Non-Reim	1	0	1
	0901519N	Service Support to Non-DoD Act - Reimbursable	13	26	39
	0902398M	Mgt HQ - Departmental	8	4	12

Table A-2. Navy Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0902398N	Mgt HQ - Departmental	40	3	43
	0902498N	Mgt HQ - Administrative	1	0	1
	1001010N	Miscellaneous Support to other Nations	0	1	1
	1001098N	Mgt HQ - International	3	3	6
	1100011N	Ongoing Operational Activities - Active	7	166	173
	1100611N	Ongoing Operational Activities - Reserve	0	5	5
	1120011N	Training - Active	2	21	23
	1180098N	Mgt HQ - SOFCOM	1	1	2
Not elsewhere classified		In DMDC personnel database, but without a known PE	38	7	45
Total			11,792	30,678	42,470

Table A-3. Air Force Medical Program Elements

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
COMA, Fully Medical	0401124F	Aeromedical Airlift Squadrons - IF	0	0	0
	0504216F	Aeromedical Evacuation Units - Air Force Reserve - Associate	0	0	0
	0508211F	Medical Service Units - Air Force Reserve	1	2	3
	0508212F	Aeromedical Evacuation Units - Air Force Reserve	0	0	0
	0508213F	Medical Mobilization Augmentees - Air Force Reserve	0	0	0
	0508221F	Medical Readiness Units - Air National Guard	0	0	0
	0508222F	Aeromedical Evacuation Units - Air National Guard	0	0	0
	0604703F	Aeromedical Systems Development	0	0	0
	0605306F	Ranch Hand II Epidemiology Study	1	2	3
	0806722F	Armed Forces Health Professions Scholarship Program	0	0	0
	0806761F	Education and Training Health Care	578	469	1,047
	0806861F	Education and Training - Health Care - JMMC	348	0	348
	0807711F	Care in Regional Defense Facilities	1,899	3,173	5,072
	0807712F	CHAMPUS	0	0	0
	0807713F	Ca[illegible]n Non-Defense Facilities	0	0	0
	0807714F	Other Health Activities	845	2,567	3,412
	0807715F	Dental Care Activities	1,152	3,082	4,234
	0807790F	Visual Information Activities - Medical	0	1	1
	0807792F	Station Hospitals & Medical Clinics	6,578	14,723	21,301
	0807794F	RPMA - Health Care	0	0	0
	0807795F	Base Communications - Health Care	0	0	0
	0807811F	Care in Regional Defense Facilities - JMMC	918	1,629	2,547
	0807813F	Care in Non-Defense Facilities - JMMC	0	0	0
	0807814F	Other Health Activities - JMMC	18	87	105
	0807815F	Dental Care Activities - JMMC	81	233	314

Table A-3. Air Force Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
COMA, Fully Medical	0807890F	Visual Information Activities - Medical - JMMC	0	0	0
	0807892F	Station Hospitals & Medical Clinics - JMMC	69	165	234
	0807894F	RPMA - Health Care - JMMC	0	0	0
COMA, Partially Medical	0807895F	Base Communications - Health Care - JMMC	0	0	0
	0809712F	Service Support to USUHS	31	32	63
	0208031F	WRM - Equipment/Secondary Items	0	1	1
	0208032F	Stock Funded WRM - Service Controlled	0	0	0
	0601102F	Defense Research Sciences	1	0	1
	0602202F	Aerospace Biotechnology	102	162	264
	0801713F	Examining Activities	5	69	74
	0902398F	Mgt HQ - Departmental	23	6	29
Non-COMA	0101113F	B-52 Squadrons	0	4	4
	0101115F	FB-111 Squadrons	0	1	1
	0101126F	B-1B Squadrons	0	1	1
	0101128F	B-52 Conventional Squadrons	0	2	2
	0101142F	KC-135 Squadrons	5	13	18
	0101213F	Minuteman Squadrons	1	12	13
	0101215F	Peacekeeper Squadrons	0	1	1
	0101312F	PACCS and WWABNCP Sys EC-135 Class V Mods	0	2	2
	0101316F	USSTRATCOM Command and Control	0	1	1
	0101317F	PACCS Communications	0	1	1
	0101820F	Mission Evaluation Activity - Offensive	0	1	1
	0101894F	RPMA - Offensive	1	3	4
	0101895F	Base Communications - SAC	0	1	1
	0101896F	Base Ops - Offensive	1	13	14
	0101898F	Mgt HQ - USSTRATCOM	16	22	38
	0102116F	Air Defense F-15	1	1	2
	0102431F	Defense Support Program	0	1	1
	0102496F	Base Ops - Space Command	0	0	0
	0102498F	Mgt HQ - Space Command	4	2	6
	0102894F	RPMA - Defensive	0	1	1
	0102896F	Base Ops - Defensive	0	2	2
	0102897F	Training - Defensive	1	2	3
	0102898F	Mgt HQ - Strategic Defensive Forces	0	2	2

Table A-3. Air Force Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0201113F	US European Command (USEUCOM) Activities	0	2	2
	0201398F	Mgt HQ - USEUCOM	1	0	1
	0201498F	Mgt HQ - PACOM	2	1	3
	0201598F	Mgt HQ - SOUTHCOM	1	1	2
	0201898F	Mgt HQ US Central Command	2	0	2
	0207128F	F-4 Squadrons	2	3	5
	0207129F	F-111 Squadrons	5	11	16
	0207130F	F-15A/B/C/D Squadrons	16	28	44
	0207131F	A-10 Squadrons	13	27	40
	0207133F	F-16 Squadrons	21	41	62
	0207134F	F-15E Squadrons	3	2	5
	0207136F	Manned Destructive Suppression	1	4	5
	0207141F	F-117A Squadrons	2	5	7
	0207213F	RF-4 Squadrons	4	3	7
	0207218F	Tactical Fighter Training - Aggressor Squadrons	0	1	1
	0207222F	KC-10A	0	3	3
	0207236F	Operational HQ - Tactical Air Forces	21	9	30
	0207252F	EF-111 Squadrons	2	8	10
	0207253F	Compass Call	1	8	9
	0207314F	Ground Launched Cruise Missile	3	12	15
	0207412F	Tactical Air Control System	0	26	26
	0207417F	Airborne Warning and Control System (AWACS)	6	16	22
	0207418F	Tactical Airborne Control Systems	3	6	9
	0207419F	Tactical Airborne Command and Control Systems	1	2	3
	0207422F	Deployable C3 Systems	0	3	3
	0207426F	Air Force Operational Test/Evaluation Center (AFOTEC)	3	0	3
	0207430F	Civil Engineer Squadrons - Heavy Repair	0	8	8
	0207431F	Tactical Air Intelligence System Activities	1	0	1
	0207593F	Chem/Bio Defense Program	0	2	2
	0207594F	RPMA - Tactical Air Forces	2	3	5
	0207596F	Base Ops - Tactical Air Forces	7	37	44
	0207597F	Training - Tactical Air Forces	4	16	20
	0207598F	Mgt HQ - Tactical Air Forces	45	29	74

Table A-3. Air Force Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0208015F	Combat Developments	2	0	2
	0208019F	Tactical Cryptologic Activities	0	2	2
	0208021F	Electronic Combat Support	0	1	1
	0208028F	Camouflage, Concealment, & Deception	0	1	1
	0208030F	WRM - Ammunition	0	1	1
	0208090F	Visual Information Activities - Tactical	0	1	1
	0208098F	Mgt HQ (Electronic Security Command)	1	0	1
	0301011F	Cryptologic Activities	1	9	10
	0301196F	Base Ops - Cryptologic	0	1	1
	0301198F	Mgt HQ - Cryptologic	0	1	1
	0301305F	Intelligence Production Activities	3	0	3
	0301310F	Foreign Technology Division	0	0	0
	0301328F	Strategic Air Command GDIP Activities	0	2	2
	0302015F	National Emergency Abn Command Post & E4A Class V	0	2	2
	0303112F	Air Force Communications - AIRCOM	0	4	4
	0303126F	Long-Haul Communications - DCS	0	5	5
	0303151F	WWMCCS - ADP	1	0	1
	0303605F	Satellite Communications Terminals	0	3	3
	0303998F	Mgt HQ - COMM	0	1	1
	0305111F	Weather Service	0	6	6
	0305114F	Air Traf Control/Approach/Landing System (TRACALS)	0	15	15
	0305123F	AFCC Engineering/Installations	0	1	1
	0305127F	Foreign Counterintelligence Activities	0	3	3
	0305128F	Security/Investigative Activities	1	18	19
	0305151F	Satellite Control Facility - Communications	0	2	2
	0305805F	Service Support to NSA - NFIP	4	5	9
	0305808F	Service Support to DISA	0	1	1
	0305809F	Service Support to DIA - NFIP	0	3	3
	0305887F	Electronic Combat Intelligence Support	0	1	1
	0305892F	Special Analysis Activities	0	1	1
	0305895F	Base Communications	0	1	1

Table A-3. Air Force Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0308610F	Info Mgt - Automation - Program 3	4	13	17
	0401115F	C-130 Airlift Squadron	9	20	29
	0401119F	C-5 Airlift Squadrons - IF	0	2	2
	0401122F	Airlift Support Services - IF	1	1	2
	0401125F	Aerial Port Squadrons - IF	0	3	3
	0401216F	Airlift Mission Activities - Non-IF	0	10	10
	0401314F	Operational Support Airlift	0	6	6
	0401894F	RPMA - Airlift	0	1	1
	0401895F	Command and Base Comm - MAC	0	1	1
	0401896F	Base Ops - Airlift	10	18	28
	0401897F	Training	0	3	3
	0401898F	Mgt HQ - Airlift - Non-IF	19	10	29
	0501421F	KC-135 Squadrons Air Force Reserve	0	0	0
	0502713F	A-10 Squadrons - Air Force Reserve	0	0	0
	0502714F	B-52 Squadrons - Air Force Reserve	0	0	0
	0502716F	F-16 Squadrons - Air Force Reserve	0	0	0
	0502721F	KC-10 Squadrons - US Air Force Reserve	0	0	0
	0503122F	Aerospace Rescue/Recovery - Air Force Reserve	0	0	0
	0504210F	C-141 Strategic Airlift Squadrons - Air Force Reserve - Equipped	0	0	0
	0504215F	C-141 Airlift Squadrons - Air Force Reserve - Associate	0	0	0
	0504217F	C-5 Airlift Squadrons - Air Force Reserve - Associate	0	0	0
	0504219F	C-5 Strategic Airlift Squadrons - Air Force Reserve -	0	0	0
	0504343F	C-130 Tactical Airlift Squadrons - Air Force Reserve	1	0	1
	0505294F	RPMA - Air National Guard	0	0	0
	0505396F	Base Ops - Other Air Force Reserve	0	0	0
	0509298F	Mgt HQ - Air National Guard	2	0	2
	0509330F	Reserve Readiness Support Air Force Reserve	3	0	3

Table A-3. Air Force Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0509392F	Personnel Administration - Air Force Reserve	2	2	4
	0509398F	Mgt HQ - Air Force Reserve	2	2	4
	0602302F	Rocket Propulsion and Astronautics Technology	1	1	2
	0605807F	Test and Evaluation Support	3	2	5
	0605896F	Base Ops - RDT&E	0	1	1
	0605906F	Service Support to DNA	4	3	7
	0702007F	Depot Maintenance (IF)	0	0	0
	0702207F	Depot Maintenance (Non-IF)	0	1	1
	0702806F	Acquisition and Command Support	20	12	32
	0702829F	Logistics Administrative Support	1	0	1
	0702891F	Commissary Retail Sales	1	2	3
	0702894F	RPMA - Logistics	17	5	22
	0702896F	Base Ops - Logistics	6	16	22
	0702898F	Mgt HQ - Logistics	41	15	56
	0708008F	Defense Environmental Restoration Program (DERP)	0	0	0
	0708065F	Stock Fund Operations	1	0	1
	0708110F	Service Support to DLA	8	0	8
	0801711F	Recruiting Activities	74	113	187
	0801714F	Personnel Processing Activities	0	3	3
	0804711F	Recruit Training Units	0	27	27
	0804721F	Service Academies	8	11	19
	0804724F	Other College Commissioning Programs	414	66	480
	0804731F	General Skill Training	353	479	832
	0804734F	Crypto/SIGINT-Related Skill Training	0	4	4
	0804742F	Undergraduate Navigator/NFO Training (UNT)	0	1	1
	0804748F	Flight Screening	1	0	1
	0804751F	Professional Military Education	27	7	34
	0804752F	Other Professional Education	0	2	2
	0805794F	RPMA - Training	0	1	1
	0805795F	Base Communications - Training	0	2	2
	0805796F	Base Ops - Training	1	10	11
	0805798F	Mgt HQ - Training	19	7	26
	0808711F	American Forces Info Service-Field Activities	0	2	2
	0808715F	Overseas Dependents Ed-Field Activities	1	0	1

Table A-3. Air Force Medical Program Elements (Continued)

	PE	Title	Active-Duty Medical Personnel		
			Officer	Enlisted	Total
Non-COMA (Continued)	0808716F	Other Personnel Activities	7	13	20
	0808717F	DoD Dependents Section VI Schools	0	0	0
	0808721F	Personnel Holding Account	10	38	48
	0808732F	Transients	306	510	816
	0809703F	Service Support to OSD	14	1	15
	0809732F	Off-Duty & Voluntary Education Programs	0	4	4
	0901212F	Service-Wide Support - (Not Otherwise Accounted For)	138	30	168
	0901220F	Personnel Administration	37	8	45
	0901296F	Base Ops - Administrative	0	1	1
	0901503F	Service Support to OSD	15	0	15
	0901507F	Service Support to JCS	3	0	3
	0901518F	Service Support to Non-DoD Activities - Non-Reim	4	1	5
	0901519F	Service Support to Non-DoD Act - Reimbursable	1	0	1
	0902898F	Mgt HQ - ADP Support - OSD	0	1	1
	0904901F	Undistributed Adjustments	354	47	401
	1001004F	International Activities	1	0	1
	1001010F	Miscellaneous Support to other Nations	0	1	1
	1001012F	NATO AEW&C Program	14	41	55
	1001098F	Mgt HQ (International)	2	0	2
	1002002F	Foreign Military Sales Support (Reimbursable)	1	2	3
	1100011F	Ongoing Operational Activities - Active	4	12	16
	1100611F	Ongoing Operational Activities - Reserve	0	0	0
	1120011F	Training - Activities	2	0	2
	1180098F	Mgt HQ - SOFCOM	1	0	1
Not elsewhere classified		In DMDC personnel database, but without a known PE	40	4	44
Total			14,873	28,499	43,372

APPENDIX B
IDA MEDICAL PAY RATES

APPENDIX B
IDA MEDICAL PAY RATES

The following tables present the calculation of the IDA medical pay rates that were used to adjust the FYDP Military Personnel (MilPers) costs of the medical personnel in Chapter II of the text. Tables B-1, B-2, and B-3 deal with rates for the Army, Navy and Marine Corps, and Air Force, respectively. The IDA rates, which are shown in the final column, are derived by making a variety of adjustments to the rates derived by OSD (Health Affairs), shown in the first column. The OSD (Health Affairs) figures for optometrists are for FY 1992; the other figures in the column are for FY 1991.

The OSD (Health Affairs) rates that we show for enlisted personnel are less than the rates shown in the official tables. The reason is that the OSD (Health Affairs) figures contain double-counting, which has been eliminated from the present tables.

Table B-1. FY90 IDA Medical Pay Rates: Army

	Grade	FY91 Health Affairs Rate	Less PCS	Less Health Care Accrual	Less Accession and Training	Adjusted FY91 Health Affairs Rate	Deflation Rate	Computed FY90 Health Affairs Rate	Plus Employer Social Security Adjustment	IDA Pay Rate
Physician	O3	$82,436	$3,793	$3,451	$12,116	$63,076	0.95781	$60,415	$2,522	$62,937
	O4	$121,358	$3,793	$3,451	$12,116	$101,998	0.95781	$97,695	$2,522	$100,217
	O5	$138,947	$3,793	$3,451	$12,116	$119,587	0.95781	$114,542	$2,522	$117,064
	O6	$156,373	$3,793	$3,451	$12,116	$137,013	0.95781	$131,232	$2,522	$133,754
	O7	$164,325	$3,793	$3,451	$12,116	$144,965	0.95781	$138,849	$2,522	$141,371
	O8	$178,556	$3,793	$3,451	$12,116	$159,196	0.95781	$152,480	$2,522	$155,002
	O9	$190,836	$3,793	$3,451	$12,116	$171,476	0.95781	$164,241	$2,522	$166,763
Dentist	O3	$65,469	$3,793	$3,451	$396	$57,829	0.95781	$55,389	$2,522	$57,911
	O4	$82,102	$3,793	$3,451	$396	$74,462	0.95781	$71,320	$2,522	$73,842
	O5	$99,545	$3,793	$3,451	$396	$91,905	0.95781	$88,028	$2,522	$90,550
	O6	$119,764	$3,793	$3,451	$396	$112,124	0.95781	$107,393	$2,522	$109,915
	O7	$139,305	$3,793	$3,451	$396	$131,665	0.95781	$126,110	$2,522	$128,632
	O8	$152,951	$3,793	$3,451	$396	$145,311	0.95781	$139,180	$2,522	$141,702
Optometrist	O3	$71,016	$3,793	$3,451	$4,630	$59,142	.92237	$54,551	$2,522	$57,073
	O4	$86,614	$3,793	$3,451	$4,630	$74,740	0.92237	$68,938	$2,522	$71,460
	O5	$101,102	$3,793	$3,451	$4,630	$89,228	0.92237	$82,301	$2,522	$84,823
	O6	$119,897	$3,793	$3,451	$4,630	$108,023	0.92237	$99,637	$2,522	$102,159
Veterinarian	O3	$63,785	$3,793	$3,451	$536	$56,005	0.95781	$53,642	$2,522	$56,164
	O4	$78,690	$3,793	$3,451	$536	$70,910	0.95781	$67,918	$2,522	$70,440
	O5	$92,804	$3,793	$3,451	$536	$85,024	0.95781	$81,437	$2,522	$83,959
	O6	$110,619	$3,793	$3,451	$536	$102,839	0.95781	$98,500	$2,522	$101,022

Table B-1. FY90 IDA Medical Pay Rates: Army (Continued)

	Grade	FY91 Health Affairs Rate	Less PCS	Less Health Care Accrual	Less Accession and Training	Adjusted FY91 Health Affairs Rate	Deflation Rate	Computed FY90 Health Affairs Rate	Plus Employer Social Security Adjustment	IDA Pay Rate
Nurse	O1	$41,746	$3,793	$3,451	$650	$33,252	0.95781	$32,424	$2,522	$34,946
	O2	$52,231	$3,793	$3,451	$650	$44,337	0.95781	$42,466	$2,522	$44,988
	O3	$63,338	$3,793	$3,451	$650	$55,444	0.95781	$53,105	$2,522	$55,627
	O4	$76,993	$3,793	$3,451	$650	$69,099	0.95781	$66,184	$2,522	$68,706
	O5	$90,047	$3,793	$3,451	$650	$82,153	0.95781	$78,687	$2,522	$81,209
	O6	$106,781	$3,793	$3,451	$650	$98,887	0.95781	$94,715	$2,522	$97,237
	O7	$125,190	$3,793	$3,451	$650	$117,296	0.95781	$112,347	$2,522	$114,869
Warrant	W1	$44,956	$3,793	$3,451	$0	$37,712	0.95781	$36,121	$2,522	$38,643
	W2	$52,020	$3,793	$3,451	$0	$44,776	0.95781	$42,887	$2,522	$45,409
	W3	$62,772	$3,793	$3,451	$0	$55,529	0.95781	$53,186	$2,522	$55,708
	W4	$75,108	$3,793	$3,451	$0	$67,864	0.95781	$65,001	$2,522	$67,523
Medical Service	O1	$42,243	$3,793	$3,451	$1,474	$33,525	0.95781	$32,111	$2,522	$34,633
	O2	$53,028	$3,793	$3,451	$1,474	$44,310	0.95781	$42,441	$2,522	$44,963
	O3	$63,650	$3,793	$3,451	$1,474	$54,941	0.95781	$52,623	$2,522	$55,145
	O4	$78,625	$3,793	$3,451	$1,474	$69,907	0.95781	$66,958	$2,522	$69,480
	O5	$92,510	$3,793	$3,451	$1,474	$83,792	0.95781	$80,257	$2,522	$82,779
	O6	$110,561	$3,793	$3,451	$1,474	$101,843	0.95781	$97,546	$2,522	$100,068
Enlisted	E1	$21,317	$1,289	$3,451	$0	$16,577	0.95781	$15,878	$1,112	$16,990
	E2	$23,864	$1,289	$3,451	$0	$19,124	0.95781	$18,317	$1,112	$19,429
	E3	$25,303	$1,289	$3,451	$0	$20,563	0.95781	$19,695	$1,112	$20,807
	E4	$28,321	$1,289	$3,451	$0	$23,581	0.95781	$22,586	$1,112	$23,698
	E5	$32,911	$1,289	$3,451	$0	$28,171	0.95781	$26,982	$1,112	$28,094
	E6	$38,191	$1,289	$3,451	$0	$33,451	0.95781	$32,040	$1,112	$33,152
	E7	$44,043	$1,289	$3,451	$0	$39,303	0.95781	$37,645	$1,112	$38,757
	E8	$50,766	$1,289	$3,451	$0	$46,026	0.95781	$44,084	$1,112	$45,196
	E9	$59,836	$1,289	$3,451	$0	$55,096	0.95781	$52,771	$1,112	$53,883

Table B-2. FY90 IDA Medical Pay Rates: Navy

	Grade	FY91 Health Affairs Rate	Less PCS	Less Health Care Accrual	Less Accession and Training	Adjusted FY91 Health Affairs Rate	Deflation Rate	Computed FY90 Health Affairs Rate	Plus Employer Social Security Adjustment	IDA Pay Rate
Physician	O3	$82,645	$2,434	$3,451	$12,116	$64,644	0.95641	$61,826	$2,449	$64,275
	O4	$119,705	$2,434	$3,451	$12,116	$101,704	0.95641	$97,271	$2,449	$99,720
	O5	$136,787	$2,434	$3,451	$12,116	$118,786	0.95641	$113,608	$2,449	$116,057
	O6	$153,943	$2,434	$3,451	$12,116	$135,942	0.95641	$130,016	$2,449	$132,465
	O7	$163,011	$2,434	$3,451	$12,116	$145,010	0.95641	$138,689	$2,449	$141,138
	O8	$177,199	$2,434	$3,451	$12,116	$159,198	0.95641	$152,259	$2,449	$154,708
	O9	$189,476	$2,434	$3,451	$12,116	$171,475	0.95641	$164,000	$2,449	$166,449
Dentist	O3	$65,209	$2,434	$3,451	$396	$58,928	0.95641	$56,359	$2,449	$58,808
	O4	$81,155	$2,434	$3,451	$396	$74,874	0.95641	$71,610	$2,449	$74,059
	O5	$99,566	$2,434	$3,451	$396	$93,285	0.95641	$89,219	$2,449	$91,668
	O6	$119,669	$2,434	$3,451	$396	$113,388	0.95641	$108,445	$2,449	$110,894
	O7	$137,970	$2,434	$3,451	$396	$131,689	0.95641	$125,949	$2,449	$128,398
	O8	$153,288	$2,434	$3,451	$396	$147,007	0.95641	$140,599	$2,449	$143,048
Optometrist	O3	$71,224	$2,434	$3,451	$4,630	$60,709	0.92125	$55,928	$2,449	$58,377
	O4	$86,325	$2,434	$3,451	$4,630	$75,810	0.92125	$69,840	$2,449	$72,289
	O5	$101,156	$2,434	$3,451	$4,630	$90,641	0.92125	$83,503	$2,449	$85,952
	O6	$118,566	$2,434	$3,451	$4,630	$108,051	0.92125	$99,542	$2,449	$101,991
Nurs	O1	$40,063	$2,434	$3,451	$650	$33,528	0.95641	$32,067	$2,449	$34,516
	O2	$50,870	$2,434	$3,451	$650	$44,335	0.95641	$42,402	$2,449	$44,851
	O3	$61,780	$2,434	$3,451	$650	$55,245	0.95641	$52,837	$2,449	$55,286
	O4	$75,412	$2,434	$3,451	$650	$68,877	0.95641	$65,875	$2,449	$68,324
	O5	$88,701	$2,434	$3,451	$650	$82,166	0.95641	$78,584	$2,449	$81,033
	O6	$105,229	$2,434	$3,451	$650	$98,694	0.95641	$94,392	$2,449	$96,841
	O7	$123,846	$2,434	$3,451	$650	$117,311	0.95641	$112,197	$2,449	$114,646

Table B-2. FY90 IDA Medical Pay Rates: Navy (Continued)

	Grade	FY91 Health Affairs Rate	Less PCS	Less Health Care Accrual	Less Accession and Training	Adjusted FY91 Health Affairs Rate	Deflation Rate	Computed FY90 Health Affairs Rate	Plus Employer Social Security Adjustment	IDA Pay Rate
Warrant	W1	$43,587	$2,434	$3,451	$0	$37,702	0.95641	$36,059	$2,449	$38,508
	W2	$50,694	$2,434	$3,451	$0	$44,809	0.95641	$42,856	$2,449	$45,305
	W3	$61,435	$2,434	$3,451	$0	$55,550	0.95641	$53,129	$2,449	$55,578
	W4	$73,762	$2,434	$3,451	$0	$67,877	0.95641	$64,918	$2,449	$67,367
Medical Service	O1	$40,831	$2,434	$3,451	$1,390	$33,556	0.95641	$32,093	$2,449	$34,542
	O2	$51,603	$2,434	$3,451	$1,390	$44,328	0.95641	$42,396	$2,449	$44,845
	O3	$66,732	$2,434	$3,451	$1,390	$59,457	0.95641	$56,865	$2,449	$59,314
	O4	$81,83[illegible]	$2,434	$3,451	$1,390	$74,559	0.95641	$71,309	$2,449	$73,758
	O5	$96,665	$2,434	$3,451	$1,390	$89,390	0.95641	$85,493	$2,449	$87,942
	O6	$114,075	$2,434	$3,451	$1,390	$106,800	0.95641	$102,145	$2,449	$104,594
	O7	$124,463	$2,434	$3,451	$1,390	$117,188	0.95641	$112,080	$2,449	$114,529
Enlisted	E1	$21,094	$985	$3,451	$0	$16,658	0.95641	$15,932	$1,031	$16,963
	E2	$23,671	$985	$3,451	$0	$19,235	0.95641	$18,397	$1,031	$19,428
	E3	$25,300	$985	$3,451	$0	$20,864	0.95641	$19,955	$1,031	$20,986
	E4	$28,320	$985	$3,451	$0	$23,884	0.95641	$22,843	$1,031	$23,874
	E5	$32,719	$985	$3,451	$0	$28,283	0.95641	$27,050	$1,031	$28,081
	E6	$38,175	$985	$3,451	$0	$33,739	0.95641	$32,268	$1,031	$33,299
	E7	$44,030	$985	$3,451	$0	$39,594	0.95641	$37,868	$1,031	$38,899
	E8	$50,651	$985	$3,451	$0	$46,215	0.95641	$44,200	$1,031	$45,231
	E9	$59,655	$985	$3,451	$0	$55,219	0.95641	$52,812	$1,031	$53,843

Table B-3. FY90 IDA Medical Pay Rates: Air Force

	Grade	FY91 Health Affairs Rate	Less PCS	Less Health Care Accrual	Less Accession and Training	Adjusted FY91 Health Affairs Rate	Deflation Rate	Computed FY90 Health Affairs Rate	Plus Employer Social Security Adjustment	IDA Pay Rate
Physician	O3	$84,260	$2,966	$3,451	$12,116	$65,727	0.95650	$62,868	$3,137	$66,005
	O4	$120,709	$2,966	$3,451	$12,116	$102,176	0.95650	$97,731	$3,137	$100,868
	O5	$135,892	$2,966	$3,451	$12,116	$117,359	0.95650	$112,254	$3,137	$115,391
	O6	$151,998	$2,966	$3,451	$12,116	$133,465	0.95650	$127,659	$3,137	$130,796
	O7	$163,517	$2,966	$3,451	$12,116	$144,984	0.95650	$138,677	$3,137	$141,814
	O8	$177,810	$2,966	$3,451	$12,116	$159,277	0.95650	$152,348	$3,137	$155,485
	O9	$189,995	$2,966	$3,451	$12,116	$171,462	0.95650	$164,003	$3,137	$167,140
Dentist	O3	$64,294	$2,966	$3,451	$396	$57,481	0.95650	$54,981	$3,137	$58,118
	O4	$81,726	$2,966	$3,451	$396	$74,913	0.95650	$71,654	$3,137	$74,791
	O5	$99,746	$2,966	$3,451	$396	$92,933	0.95650	$88,890	$3,137	$92,027
	O6	$119,916	$2,966	$3,451	$396	$113,103	0.95650	$108,183	$3,137	$111,320
	O7	$138,457	$2,966	$3,451	$396	$131,644	0.95650	$125,917	$3,137	$129,054
	O8	$152,068	$2,966	$3,451	$396	$145,255	0.95650	$138,936	$3,137	$142,073
Optometrist	O3	$72,393	$2,966	$3,451	$4,630	$61,346	0.92142	$56,525	$3,137	$59,662
	O4	$87,050	$2,966	$3,451	$4,630	$76,003	0.92142	$70,031	$3,137	$73,168
	O5	$102,693	$2,966	$3,451	$4,630	$91,646	0.92142	$84,444	$3,137	$87,581
	O6	$133,702	$2,966	$3,451	$4,630	$122,655	0.92142	$113,017	$3,137	$116,154
Veterinarian	O4	$80,129	$2,966	$3,451	$536	$73,176	0.95650	$69,993	$3,137	$73,130
	O5	$94,491	$2,966	$3,451	$536	$87,538	0.95650	$83,730	$3,137	$86,867
	O6	$110,874	$2,966	$3,451	$536	$103,921	0.95650	$99,400	$3,137	$102,537
Nurse	O1	$40,605	$2,966	$3,451	$650	$33,538	0.95650	$32,079	$3,137	$35,216
	O2	$51,393	$2,966	$3,451	$650	$44,326	0.95650	$42,398	$3,137	$45,535
	O3	$62,519	$2,966	$3,451	$650	$55,452	0.95650	$53,040	$3,137	$56,177
	O4	$76,102	$2,966	$3,451	$650	$69,035	0.95650	$66,032	$3,137	$69,169
	O5	$89,169	$2,966	$3,451	$650	$82,102	0.95650	$78,531	$3,137	$81,668
	O6	$105,900	$2,966	$3,451	$650	$98,833	0.95650	$94,534	$3,137	$97,671
	O7	$124,368	$2,966	$3,451	$650	$117,301	0.95650	$112,198	$3,137	$115,335

Table B-3. FY90 IDA Medical Pay Rates: Air Force (Continued)

	Grade	FY91 Health Affairs Rate	Less PCS	Less Health Care Accrual	Less Accession and Training	Adjusted FY91 Health Affairs Rate	Deflation Rate	Computed FY90 Health Affairs Rate	Plus Employer Social Security Adjustment	IDA Pay Rate
Medical Service	O1	$41,382	$2,966	$3,451	$1,408	$33,557	0.95650	$32,097	$3,137	$35,234
	O2	$52,154	$2,966	$3,451	$1,408	$44,329	0.95650	$42,401	$3,137	$45,538
	O3	$65,399	$2,966	$3,451	$1,408	$57,574	0.95650	$55,070	$3,137	$58,207
	O4	$79,481	$2,966	$3,451	$1,408	$71,656	0.95650	$68,539	$3,137	$71,676
	O5	$94,488	$2,966	$3,451	$1,408	$86,663	0.95650	$82,893	$3,137	$86,030
	O6	$110,480	$2,966	$3,451	$1,408	$102,655	0.95650	$98,190	$3,137	$101,327
Enlisted	E1	$21,770	$1,754	$3,451	$0	$16,565	0.95650	$15,844	$1,395	$17,239
	E2	$24,296	$1,754	$3,451	$0	$19,091	0.95650	$18,261	$1,395	$19,656
	E3	$25,746	$1,754	$3,451	$0	$20,541	0.95650	$19,647	$1,395	$21,042
	E4	$28,738	$1,754	$3,451	$0	$23,533	0.95650	$22,509	$1,395	$23,904
	E5	$33,331	$1,754	$3,451	$0	$28,126	0.95650	$26,903	$1,395	$28,298
	E6	$38,662	$1,754	$3,451	$0	$33,457	0.95650	$32,002	$1,395	$33,397
	E7	$44,596	$1,754	$3,451	$0	$39,391	0.95650	$37,677	$1,395	$39,072
	E8	$51,363	$1,754	$3,451	$0	$46,158	0.95650	$44,150	$1,395	$45,545
	E9	$60,442	$1,754	$3,451	$0	$55,237	0.95650	$52,834	$1,395	$54,229

APPENDIX C
ESTIMATION OF CONSTRUCTION-COST ADJUSTMENT FACTOR

APPENDIX C
ESTIMATION OF CONSTRUCTION-COST ADJUSTMENT FACTOR

PREVIOUS WORK RELATING CONSTRUCTION AND OPERATING COSTS

Previous work conducted by Vector Research, Incorporated (VRI) led to the development of a construction-cost model for DoD MTFs that gives annualized construction costs as a percentage of annual inpatient and ambulatory operating costs. This section contains a detailed description of that model and the underlying methodology.

The purpose of the study was to provide a convenient method for adjusting marginal operating costs to account for the accompanying costs of constructing the facility and purchasing initial medical equipment prior to operation. The primary assumption of the model is that a facility will be sized to its expected level of operation. Annualized construction costs are defined as the annual outlay required to "repay" the initial construction-cost "loan" over the life of a facility, given an assumed discount rate and facility lifespan. [1]

A simple linear model of the following form served as the basis for the analysis:

$$CC = B_0 + B_1 \times OC,$$

where:

- CC = annualized construction cost,
- B_0 = fixed construction-cost component,
- B_1 = variable construction-cost component, and
- OC = estimated inpatient and ambulatory-care operating costs.

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[1] This method of linking annualized construction cost to annual operating cost was also used by the General Accounting Office (GAO) in its analysis of the allocation of capital costs for Medicare patients. See "Medicare: Alternatives for Paying Hospital Capital Costs," U.S. General Accounting Office, Report to the Chairman, Subcommittee on Health, Committee on Ways and Means, House of Representatives, August 1986.

Data Sources

Pairs of operating-cost and construction-cost estimates were taken from 14 separate economic analyses (EAs). Each EA provided cost estimates for at least two, and often several, construction scenarios. Each construction scenario corresponded to an individual projection of health-care services for the population surrounding the prospective MTF. Variation in utilization projections provided variation in both projected operating and construction costs. The estimated costs associated with each EA scenario became a single observation in the analysis. A total of 37 construction scenarios were available from the EAs. A description of the methods used to standardize these cost estimates can be found in the next section.

Construction-cost estimates reported for most of the EAs were based upon the detailed bottom-up estimates from the Program for Design produced by a Delta Research proprietary model. The reported costs were initially estimated in 1984 dollars, and inflated to the midpoint of the construction interval using forecasts of DoD escalation rates. The lone exception to this estimation method was found in the Cherry Point EA. In that EA, the construction-cost estimates were based on unit costs of MTFs provided by the government.

The operating-cost estimates reported in the EAs for each scenario include estimates of military personnel, civilian personnel, and non-personnel operating costs. In each EA, operating costs were forecasted from regressions on levels of both inpatient and outpatient utilization by clinical area. Historical operating-cost and utilization data from MEPRS and its predecessor, the DoD Uniform Chart of Accounts database, were used to estimate these models. The base years for these models varied from 1983 to 1987, depending on the EA; the majority had a base year of 1984. The reported operating-cost estimates had been inflated from the base year to the opening date of the facility using escalation estimates that were documented in each report.

Data Standardization

The EA construction and operating-cost estimates contain variation stemming from assumed inflation factors and area cost factors. Before the relationship between construction and operating costs could be accurately estimated, the data had to be standardized to eliminate these sources of cost variation. The geographic variation in the construction-cost data was easily eliminated after dividing the construction-cost estimates

by the provided area cost factors. Thus we were able to express construction-cost estimates in terms of U.S. national averages.

The standardization for cost inflation was more problematic, requiring assumptions of both construction-cost inflation and operating-cost inflation. The cost data from each EA had to be either inflated or deflated to a particular standardization year. Unfortunately, different inflation assumptions for both construction and operating costs will produce different relative-price relationships between construction and operating costs in the standardization year. The assumed relative-price change will directly affect the estimated relationship between construction and operating costs. Therefore, the standardization method selected was critical to the analysis.

The data were standardized for inflation using the method that required the fewest assumptions and that provided results closest to actual cost estimates. We selected 1984 as the standardization year. All of the construction-cost estimates, except for the Cherry Point EA, and the majority of the operating-cost estimates were already based upon data from 1984. Initially, the nominal-dollar cost estimates found in the EAs were divided by their respective published inflation rates to return costs to base-year estimates. After this step, relatively few inflation-rate assumptions were required to standardize the data to 1984. For the few EAs not using 1984 as a base year, we applied inflation rates for public-hospital construction from the U.S. Bureau of the Census, "Current Construction Reports," and the medical-care consumer price index from the U.S. Bureau of Labor Statistics, "CPI Detailed Report."

The standardized data are shown in Table C-1. The table indicates both the facility name and the scenario for which the values were estimated:

- status quo—no changes in beneficiaries served,
- active-duty only—the MTF serves active-duty personnel only,
- active-duty plus family members—the MTF serves active-duty personnel and their dependents only,
- active-duty plus family members plus 5%—the MTF serves active-duty personnel, their dependents, and some retirees or other beneficiaries; and
- best economic scenario—the MTF serves beneficiaries served most economically relative to civilian sector.

Because there are multiple scenarios for each prospective hospital, the 14 hospitals yield a total of 37 possible scenarios.

Table C-1. Data for Estimation of Initial Construction-Cost Factor

Facility Name	Scenario	Estimated Operating Cost (FY84 $K)	Estimated Construction Cost (FY84 $K)	Annualized[a] Construction Cost (FY84 $K)
Cherry Point	status quo	$12,159	$35,446	$4,725
Cherry Point	active-duty only	$5,132	$21,505	$2,867
Cherry Point	active-duty + family members	$10,484	$33,415	$4,454
Cherry Point	active-duty + family members + 5%	$10,859	$33,424	$4,456
Cherry Point	best economic scenario	$15,448	$38,800	$5,172
Philadelphia	active-duty + family members + 5%	$11,336	$21,929	$2,923
Philadelphia	status quo	$15,462	$26,208	$3,494
Philadelphia	best economic scenario	$17,373	$29,638	$3,951
Barksdale	status quo	$15,598	$27,729	$3,696
Barksdale	best economic scenario	$10,474	$19,076	$2,543
McConnell	active-duty + family members + 5%	$4,342	$13,465	$1,795
McConnell	status quo	$5,749	$15,711	$2,094
McConnell	best economic scenario	$4,938	$14,436	$1,924
Davis Monthan	active-duty + family members + 5%	$9,202	$18,936	$2,524
Davis Monthan	status quo	$17,199	$30,681	$4,090
Davis Monthan	best economic scenario	$19,295	$33,310	$4,440
Mather	active-duty + family members + 5%	$11,323	$23,510	$3,134
Mather	best economic scenario	$24,309	$38,708	$5,160
Homestead	active-duty + family members + 5%	$12,223	$15,237	$2,031
Homestead	best economic scenario	$19,573	$19,854	$2,647
Nellis	active-duty + family members + 5%	$13,148	$29,953	$3,993
Nellis	best economic scenario	$21,245	$41,638	$5,551
Mountain Home	active-duty + family members + 5%	$6,829	$20,009	$2,667
Mountain Home	best economic scenario	$7,848	$23,602	$3,146
MacDill	active-duty + family members + 5%	$11,575	$22,556	$3,007
MacDill	best economic scenario	$13,663	$28,623	$3,815
MacDill	maximum	$29,850	$50,486	$6,730
Ft. Bragg	active-duty + family members + 10%	$34,541	$59,567	$7,940
Ft. Bragg	status quo	$43,106	$70,928	$9,455
Ft. Bragg	best economic scenario	$52,455	$83,074	$11,074
Newport	active-duty + family members + 5%	$11,638	$18,648	$2,486
Newport	best economic scenario	$9,546	$17,595	$2,345
Robins	active-duty + family members + 5%	$7,178	$15,746	$2,099
Robins	best economic scenario	$11,271	$20,059	$2,674
Holloman	active-duty + family members + 5%	$11,932	$19,845	$2,645
Holloman	status quo	$11,541	$22,324	$2,976
Holloman	best economic scenario	$10,935	$23,173	$3,089

[a] Construction cost is annualized over a 25-year lifetime at a 10% discount rate, and adjusted for a two-year construction lag.

Cost estimates based on the data from Table C-1 should be close to the relative prices of constructing and operating an MTF in 1984. We understood that, in an era of spiraling hospital operating-cost inflation, assuming constant 1984 relative prices across a forecast period may not be satisfactory. A later section of this appendix demonstrates a simple procedure to adjust the model's coefficients for assumed changes in relative inflation rates from those existing in 1984. Using the estimated 1984 model and the procedure described in the later section, inflation assumptions become a controllable portion of the cost analysis, rather than a fixed assumption.

Annualized Construction Costs

The construction costs were annualized using a mandated 10% real discount rate and a further mandated assumption of a 25-year useful life. An adjustment was also made to construction costs to reflect the fact that construction payments are made prior to the opening of the facility. This adjustment compensates for potentially lost interest income. Because the construction midpoint was assumed to be two years prior to the opening of the facility, the construction costs were multiplied by a factor of $(1 + i)^2$, where i represents the discount rate.

Modifying the basic mortgage formula[2] to account for the two-year construction lag yields the following expression for annualized construction cost:

$$CC = TCC \times (1 + i)^2 \times i / [1 - (1 + i)^{(-n)}],$$

where:

CC = annualized construction cost,

TCC = total construction cost in 1984 dollars as of the opening of the facility,

i = the discount rate, and

n = the estimated life of the facility.

The annualized construction cost is shown in the final column of Table C-1.

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2 See, for example, Stephen G. Kellison, *The Theory of Interest*, Homewood, Illinois: Richard D. Irwin, 1970, Chapter 3.

Regression analysis was conducted to express annualized construction cost, defined above, as a function of annual operating cost. The following model was estimated (in 1984 dollars):

$$CC = 1{,}033{,}701 + 0.188 \times OC.$$

To convert the model into 1990 dollars, the model parameters were adjusted for differential inflation between operating costs and construction costs between 1984 and 1990; a detailed description of this adjustment procedure is contained in a later section of this appendix. The Bureau of the Census "Current Construction Reports" stated that, during this time period, the public-hospital construction-cost index rose by 19.5%. On the other hand, the Bureau of Labor Statistics "CPI Detailed Report" stated that the medical-care component of the consumer price index rose by 52.4% during this period. Using these figures, the fixed-cost component of construction cost was multiplied by a factor of 1.195, and the marginal-cost component was multiplied by the factor of 1.195/1.524. The resulting model is:

$$CC = 1{,}235{,}273 + 0.147 \times OC.$$

Figure C-1 presents a scatterplot of the data (in 1990 dollars) with the resulting regression line. Table C-2 presents the initial regression results (in 1984 dollars) and the adjusted regression results (in 1990 dollars). The major finding is that, again assuming a 10% real discount rate and 25-year useful life, annualized construction costs are roughly $1.2 million per hospital plus 15% of expected annual operating costs.

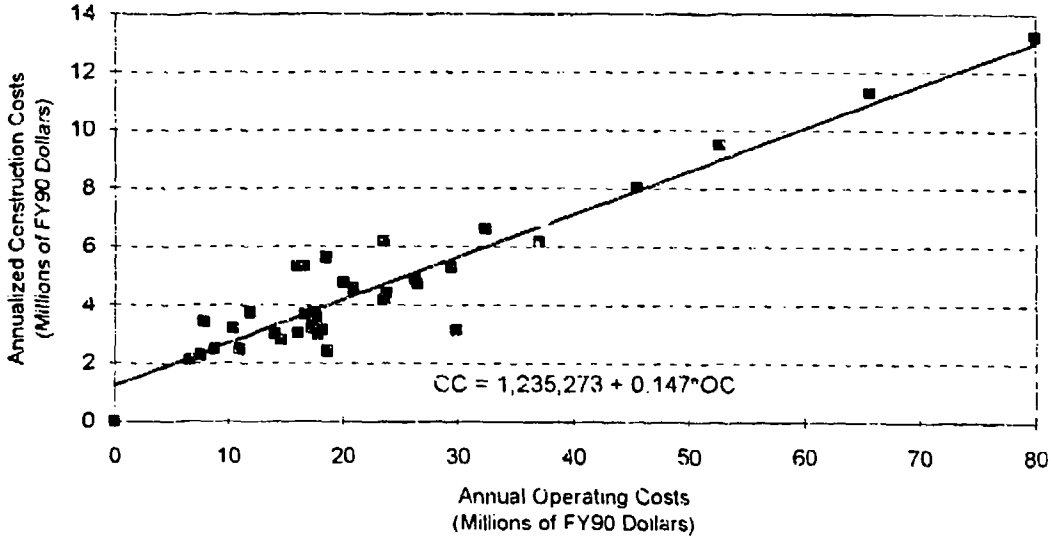

Figure C-1. Annualized Construction Costs Versus Annual Operating Costs

Table C-2. Regression Results for Initial Construction-Cost Model

Model Parameters Using FY84 Dollars		
Dependent Variable:	Annualized Construction Costs	
Number of Observations:	37	
Independent Variables	(1)	(2)
Constant	1,033,701*	1,416,337*
	(213,431)	(416,650)
Operating Cost	0.188*	0.144*
	(0.012)	(0.043)
Operating Cost Squared	N/A	0.867E-6
	N/A	(0.812E-6)
R-Squared	0.8807	0.8846

Model Parameters Using FY90 Dollars		
Dependent Variable:	Annualized Construction Costs	
Number of Observations:	37	
Independent Variables	(1)	(2)
Constant	1,235,273*	1,692.522*
	(255,050)	(497,896)
Operating Cost	0.147*	0.113*
	(0.009)	(0.034)
Operating Cost Squared	N/A	0.446E-6
	N/A	(.418E-6)
R-Squared	0.8807	0.8846

Notes: Quantities in parentheses are standard errors; asterisks indicate statistical significance.

The regression model was tested for linearity by introducing an operating-cost squared term into the regression equation. The results of the analysis, shown in the final column of Table C-2, reveal the operating-cost squared term as statistically insignificant. Therefore, the linear model appears to be adequate to describe these data.

SENSITIVITY ANALYSIS OF PREVIOUS ESTIMATES

The model developed in the previous section may be modified to account for three factors:

- changes in the discount rate,
- changes in the facility lifetime, and
- changes in relative prices (i.e., differential inflation) between construction costs and operating costs.

We first develop a simple analytical method for adjusting the construction-cost factor to account for these changes. We then apply this method to produce a more realistic construction-cost factor than the one estimated in the previous section.[3]

Adjustment Methodology

The annualized construction cost is computed by the following formula, accounting for the two-year construction lag:

(C-1) $$CC = TCC \times (1 + i)^2 \times i / [1 - (1 + i)^{(-n)}] = TCC \times F,$$

where:

CC = annualized construction cost,

TCC = total construction cost in 1984 dollars as of the opening of the facility,

i = the discount rate,

n = the estimated life of the facility, and

F = construction-cost annualization factor.

The annualized construction cost is related to operating costs through a linear model:

(C-2) $$CC = B_0 + B_1 \times OC,$$

where:

CC = annualized construction cost,

B_0 = fixed construction-cost component,

B_1 = variable construction-cost component, and

OC = estimated inpatient and ambulatory-care operating costs.

The model parameters B_0 and B_1 in equation (C-2) may be easily adjusted to account for changes in the discount rate or a facility's expected useful life. The model parameters B_0 and B_1 will simply change by the ratio of the new annualization factor (F')

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3 We also considered the effect of Graduate Medical Education (GME) programs on the construction cost/operating cost ratio. However, previous research did not detect statistical significance, see Health Care Financing Administration, "Federal Register," Vol. 52, No. 96, pp. 18846-18848 and pp. 18858-18864.

to the original annualization factor (F). For example, assume that the original annualization factor was computed using a 10% discount rate and a 25-year useful life, resulting in a value of:

$$F = (1 + .1)^2 \times .1/(1 - (1 + .1)^{-25}) = .13330.$$

It is now believed that a 4% discount rate and a 40-year useful life are more appropriate. The new annualization factor becomes:

$$F' = (1 + .04)^2 \times .04/(1 - (1 + .04)^{-40}) = .05465.$$

The model parameters would then be adjusted by the ratio

$$F'/F = .05465/.13330 = .40998,$$

resulting in the new parameters

$$B_0' = B_0 \times .40998$$

and

$$B_1' = B_1 \times .40998.$$

Next consider differential inflation between construction costs and operating costs. If the initial model parameters are in terms of a particular base year and one wants to modify the parameters to reflect a more current year, then the model parameters merely have to be adjusted for the perceived rates of inflation with respect to both construction costs and operating costs. If construction costs increased by a factor of h between the base year and the desired year, then both B_0 and B_1 have to be multiplied by the same factor h:

$$B_0' = B_0 \times h$$

and

$$B_1' = B_1 \times h.$$

If operating costs increased by a factor k, then B_1 has to be *divided* by the factor k:

$$B_1' = B_1/k$$

B_0 is not adjusted in the latter case, because the fixed cost of construction is not sensitive to inflation in operating costs.

Choice of Discount Rate

The discount rate may be operationally defined as the interest rate that the government pays on its debt. It may be stated in real or nominal terms, and it fluctuates according to the length of repayment of the debt incurred. The discount rate with respect to government projects is most accurately represented as the interest rate paid on government notes, bills, and bonds. Our analysis was conducted using real-dollar amounts, thus the discount rate used will also be stated in real-dollar terms to maintain consistency.

The Office of Management and Budget (OMB) suggests that a discount rate be chosen to match the life of the project under consideration, because it is assumed that the Government will finance a project in accordance with its useful life. If a project is estimated to yield benefits for 30 years, for example, then the appropriate discount rate is the real interest rate paid on a 30-year government bond.[4]

The previous model used a 10% real discount rate. That conservative figure might be appropriate for bounding a cost-benefit analysis, but it would not be appropriate for a cost-effectiveness comparison between competing alternatives. To remain in accordance with OMB-recommended procedures and to better estimate actual costs, we changed the discount rate used in this analysis to the appropriate real interest rate paid on a government bond with a similar life. By current OMB standards, that rate would not exceed 3.8%, which is the historical real interest rate paid on a 30-year government bond. This method of discount-rate selection is also recommended by the U.S. Department of Energy when estimating the capital costs of federal buildings.[5]

The effects of changing the discount rate can be substantial. The results of a sensitivity analysis using the initial regression-model parameters (expressed in FY90 dollars) are displayed in Table C-3 and Figure C-2.

For example, a change in the discount rate from 10% to 3.8%, with the life of the facility held at 25 years, would have the effect of changing the original FY90 regression equation from

$$CC = 1{,}235{,}273 + 0.1470 \times OC$$

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4 U.S. Office of Management and Budget, Circular No. A-94, Revised Transmittal Memorandum No. 64, October 29, 1992.

5 "Federal Energy Management and Planning Programs; Life Cycle Cost Methodology and Procedures; Proposed Rules." U.S. Department of Energy, Office of Conservation and Renewable Energy. *Federal Register*, January 25, 1990.

to:

$$CC = 625{,}690 + 0.0745 \times OC.$$

Effectively, annual construction costs as a percentage of operating costs would be decreased from 14.7% to 7.45% (at the margin), a change of roughly 50%.

Table C-3. Sensitivity Analysis of Construction-Cost Factor (FY90 Dollars)

		Facility Lifetime									
		5	10	15	20	25	30	35	40	45	50
	2.0%	24.3%	12.8%	8.9%	7.0%	5.9%	5.1%	4.6%	4.2%	3.9%	3.7%
	2.5%	24.9%	13.2%	9.4%	7.4%	6.3%	5.5%	5.0%	4.6%	4.3%	4.1%
D	3.0%	25.5%	13.7%	9.8%	7.9%	6.7%	6.0%	5.4%	5.1%	4.8%	4.5%
i	3.5%	26.2%	14.2%	10.3%	8.3%	7.2%	6.4%	5.9%	5.5%	5.3%	5.0%
s	4.0%	26.8%	14.7%	10.7%	8.8%	7.6%	6.9%	6.4%	6.0%	5.8%	5.6%
c	4.5%	27.4%	15.2%	11.2%	9.3%	8.1%	7.4%	6.9%	6.5%	6.3%	6.1%
o	5.0%	28.1%	15.7%	11.7%	9.8%	8.6%	7.9%	7.4%	7.1%	6.8%	6.7%
u	5.5%	28.7%	16.3%	12.2%	10.3%	9.2%	8.4%	8.0%	7.6%	7.4%	7.2%
n	6.0%	29.4%	16.8%	12.8%	10.8%	9.7%	9.0%	8.5%	8.2%	8.0%	7.9%
t	6.5%	30.1%	17.4%	13.3%	11.4%	10.3%	9.6%	9.1%	8.8%	8.6%	8.5%
	7.0%	30.8%	18.0%	13.9%	11.9%	10.8%	10.2%	9.8%	9.5%	9.3%	9.1%
R	7.5%	31.5%	18.6%	14.4%	12.5%	11.4%	10.8%	10.4%	10.1%	9.9%	9.8%
a	8.0%	32.2%	19.2%	15.0%	13.1%	12.0%	11.4%	11.0%	10.8%	10.6%	10.5%
t	8.5%	32.9%	19.8%	15.6%	13.7%	12.7%	12.1%	11.7%	11.5%	11.3%	11.2%
e	9.0%	33.7%	20.4%	16.3%	14.4%	13.3%	12.8%	12.4%	12.2%	12.0%	12.0%
	9.5%	34.4%	21.1%	16.9%	15.0%	14.0%	13.4%	13.1%	12.9%	12.8%	12.7%
	10.0%	35.2%	21.7%	17.5%	15.7%	14.7%	14.2%	13.8%	13.6%	13.5%	13.5%

Note: This table represents annualized construction costs as a percentage of annual operating costs (at the margin). The calculations are based on the initial construction-cost regression model (Table C-2), and all values are representative of FY90 costs for CONUS community hospitals.

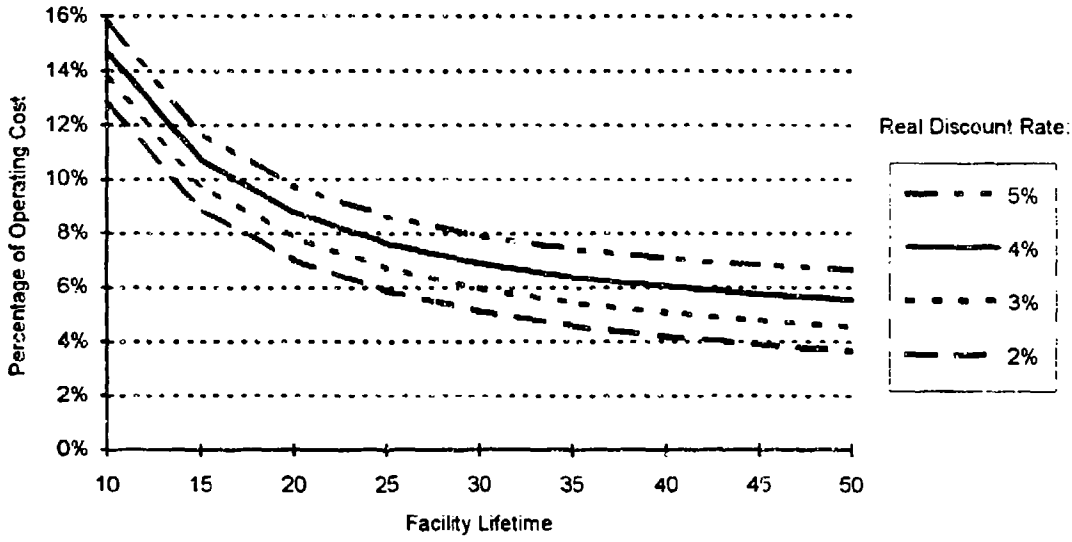

Figure C-2. Sensitivity Analysis of Construction-Cost Factor (FY90 Dollars)

Choice of Facility Lifetime

The useful life of an MTF is the period of time for which the MTF will yield benefits before it has to be rebuilt or undergo major renovations. The initial model assumed that 25 years was the useful life of a typical MTF. However, current empirical evidence regarding DoD MTFs, plus a GAO report concerning Medicare capital-cost reimbursement, suggest that this useful-life figure should be increased.

If it were assumed that DoD MTFs are constructed equally as well as private hospitals and that they operate at the same intensity, then DoD MTFs would have useful lives about equal to those of private hospitals. Research conducted by GAO concluded that private-sector hospitals have useful lives of about 40 years. This 40-year useful life is further reinforced by Medicare's capital-cost reimbursement system, which is also based on an estimated 40-year useful life.[6]

Through economic-analysis research conducted by VRI, DoD MTFs were observed to have useful lives more in accordance with this 40-year estimate than with the

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6 "Medicare: Alternatives for Paying Hospital Capital Costs," U.S. General Accounting Office, August 1986

previous 25-year estimate.[7] As can be seen in Table C-3 and Figure C-2, the effects of changing the useful life from 25 years to 40 years would not be nearly as dramatic as those of a change in the discount rate.

A change in the useful life of a DoD MTF from 25 years to 40 years, with the discount rate held at 10%, would have the effect of changing the original FY90 regression equation from:

$$CC = 1{,}235{,}273 + 0.147 \times OC$$

to:

$$CC = 1{,}146{,}630 + 0.136 \times OC.$$

Annual construction costs as a percentage of operating costs would be decreased from 14.7% to 13.6%, a relatively minor effect.

Finally, the combined effect of changing the discount rate to 3.8% and simultaneously increasing the useful life to 40 years is the following regression equation:

$$CC = 489{,}563 + .0584 \times OC.$$

This equation shows a net effect of decreasing the marginal construction-cost factor from 14.7% of operating costs to 5.84% of operating costs. The latter figure is quite similar to factors used in the civilian sector.[8]

ALTERNATIVE MODELING APPROACH

Data Sources and Standardization

The second approach uses actual inpatient and ambulatory operating costs as reported in the FY90 MEPRS data, in contrast to engineering estimates based on hypothetical annual workloads. Similarly, the construction-cost estimates were obtained after multiplying actual square footage of 87 CONUS hospitals and 17 medical centers by official DoD estimates of construction-cost per square foot. The square-footage estimates are from the Defense Medical Facilities Office (DMFO), and the construction-

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7 Based on personal communication with Ani Turner, Economic Analyst, Vector Research, Inc. DoD has historically performed economic analyses of new construction or substantial renovation investments on hospitals that are over 35 years old.

8 The private-sector factors were expressed in FY82 dollars in "Medicare: Alternatives for Paying Hospital Capital Costs," U.S. General Accounting Office, August 1986. Adjusting the GAO estimate to FY90 dollars yields a mean value between 4.8% and 5.8%.

cost factors are from the Office of the Assistant Secretary of Defense (Production and Logistics).[9]

The FY92 square-footage estimates from DMFO were extrapolated back to FY90, because FY90 actual estimates were not readily available. The construction-cost factors are shown in Table C-4. These factors were originally expressed in terms of FY94 dollars. The FY94 estimates were deflated to FY90 dollars using the annual escalation rate of 3.5% contained in the cited OSD report.

Table C-4. Construction-Cost Factors (per square foot) for Military Hospitals

Facility Type	FY94	FY90
Station Hospitals	$149	$130
Regional Medical Centers	$176	$153
Troop Clinic	$121	$105
Outpatient Clinic	$121	$105
Dental Clinic	$157	$137

Table C-5 contains the following data elements for estimating the alternative construction-cost factor: the name of each facility, the facility's DMIS identification number, the facility type, the reported FY90 MEPRS operating costs [post step-down inpatient ("A" account) plus ambulatory ("B" account) expenses], the square-footage estimate for the facility, the FY90 average cost per square foot, and finally the FY90 construction-cost estimate. The latter was computed by simply multiplying the square-footage estimate by the average cost per square foot.

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9 The construction-cost estimates are contained in: "Area Cost Factors and Unit Prices for FY 1994-1995 Department of Defense Facilities Construction," Tri-Service Committee on Cost Engineering, Office of the Assistant Secretary of Defense (Production and Logistics), July 1992. In addition to facilities construction (i.e., brick and mortar), these estimates include an allowance for initial equipment to be used in both inpatient and ambulatory care.

Table C-5. Data for Estimation of Alternative Construction-Cost Factor

DMIS ID	Facility Name	Facility Type	MEPRS Operating Cost (FY90 $K)	Square Footage Estimate	Construction Cost Per Square Foot	Estimated Construction Cost (FY90 $K)
14	David Grant USAF Medical Center	Medical Center	$75,359	1,517,097	$153	$232,116
27	Naval Hospital Oakland	Medical Center	$93,330	159,576	$153	$24,415
29	Naval Hospital San Diego	Medical Center	$176,923	916,781	$153	$140,267
31	Fitzsimons Army Medical Center	Medical Center	$110,994	603,542	$153	$92,342
37	Walter Reed Army Medical Center	Medical Center	$207,286	2,638,261	$153	$403,654
47	D.D. Eisenhower Army Medical Center, Ft Gordon	Medical Center	$97,718	776,888	$153	$118,864
52	Tripler Army Medical Center, Ft. Shafter	Medical Center	$143,502	1,556,715	$153	$238,177
55	USAF Medical Center Scott	Medical Center	$42,462	246,236	$153	$37,674
66	Malcolm Grow USAF Medical Center	Medical Center	$67,211	300,417	$153	$45,964
67	National Naval Medical Center	Medical Center	$100,776	992,112	$153	$151,793
73	3380th Keesler Medical Center	Medical Center	$79,867	706,534	$153	$108,100
95	USAF Medical Center, Wright-Patterson	Medical Center	$80,760	762,128	$153	$116,606
108	William Beaumont Army Medical Center, Ft. Bliss	Medical Center	$100,188	838,564	$153	$128,300
109	Brooke Army Medical Center, Ft. Sam Houston	Medical Center	$134,735	369,065	$153	$56,467
117	Wilford Hall USAF Medical Center	Medical Center	$181,700	1,343,136	$153	$205,500
124	Naval Hospital, Portsmouth	Medical Center	$163,641	697,898	$153	$106,778
125	Madigan Army Medical Center, Ft. Lewis	Medical Center	$107,086	1,270,323	$153	$194,390
1	Fox Army Hospital, Redstone Arsenal	CONUS Hospital	$14,338	125,186	$130	$16,274
2	Noble Army Community Hospital, Ft. McClellan	CONUS Hospital	$19,895	214,139	$130	$27,838
3	Lyster Army Hospital, Ft. Rucker	CONUS Hospital	$21,134	231,684	$130	$30,119
4	Air University Regional Hospital	CONUS Hospital	$13,442	146,482	$130	$19,043
5	Bassett Army Community Hospital Ft. Wainwright	CONUS Hospital	$23,278	203,716	$130	$26,483
6	11th Air Force Medical Center	CONUS Hospital	$31,168	252,019	$130	$32,762
7	BKH Naval Station ADAK	CONUS Hospital	$3,240	28,228	$130	$3,670
8	Bliss Army Community Hospital, Ft. Huachuca	CONUS Hospital	$18,407	112,648	$130	$14,644
9	832nd Medical Group, Luke AFB	CONUS Hospital	$21,477	125,109	$130	$16,264
10	836th Medical Group	CONUS Hospital	$22,638	95,876	$130	$12,464
13	314th Medical Group	CONUS Hospital	$14,369	144,015	$130	$18,722
15	9th Medical Group	CONUS Hospital	$9,958	65,319	$130	$8,491
16	323rd Medical Group	CONUS Hospital	$19,337	132,300	$130	$17,199
18	30th Medical Group	CONUS Hospital	$13,428	119,770	$130	$15,570
19	AFSC Hospital, Edwards	CONUS Hospital	$10,449	64,772	$130	$8,420
21	22nd Strategic Hospital	CONUS Hospital	$25,860	174,110	$130	$22,634
24	Naval Hospital, Camp Pendleton	CONUS Hospital	$49,637	427,958	$130	$55,635
28	Naval Hospital, LeMoor	CONUS Hospital	$11,644	52,195	$130	$6,785
30	Naval Hospital, 29 Palms	CONUS Hospital	$10,025	180,094	$130	$23,412
32	Evans Army Hospital, Ft. Carson	CONUS Hospital	$50,731	400,284	$130	$52,037
33	USAF Academy Hospital	CONUS Hospital	$28,279	152,239	$130	$19,791
35	Naval Hospital, Groton	CONUS Hospital	$22,580	161,863	$130	$21,042

Table C-5. Data for Estimation of Alternative Construction-Cost Factor (Continued)

DMIS ID	Facility Name	Facility Type	MEPRS Operating Cost (FY90 $K)	Square Footage Estimate	Construction Cost Per Square Foot	Estimated Construction Cost (FY90 $K)
36	436th Medical Group	CONUS Hospital	$9,023	106,000	$130	$13,780
38	Naval Hospital, Pensacola	CONUS Hospital	$47,091	283,225	$130	$36,819
39	Naval Hospital, Jacksonville	CONUS Hospital	$65,627	446,750	$130	$58,078
40	Naval Hospital, Orlando	CONUS Hospital	$39,267	208,260	$130	$27,074
42	AFSC Regional Hospital, Eglin	CONUS Hospital	$44,304	270,532	$130	$35,169
43	325th Medical Group	CONUS Hospital	$17,459	85,000	$130	$11,050
45	56th Medical Group	CONUS Hospital	$29,066	185,061	$130	$24,058
46	45th Medical Group	CONUS Hospital	$11,513	74,071	$130	$9,629
48	Martin Army Community Hospital, Ft. Benning	CONUS Hospital	$54,132	438,596	$130	$57,017
49	Winn Army Community Hospital, Ft. Stewart	CONUS Hospital	$35,398	370,000	$130	$48,100
50	347th Medical Group	CONUS Hospital	$11,752	57,878	$130	$7,524
51	USAF Hospital, Robins	CONUS Hospital	$11,281	69,269	$130	$9,005
53	366th Medical Group	CONUS Hospital	$10,745	156,557	$130	$20,352
56	Naval Hospital, Great Lakes	CONUS Hospital	$42,696	447,281	$130	$58147
57	Irwin Army Hospital, Ft. Riley	CONUS Hospital	$33,495	366,000	$130	$47,580
58	Munson Army Community Hospital, Ft. Leavenworth	CONUS Hospital	$16,975	98,363	$130	$12,787
60	Blanchfield Army Community Hospital, Ft. Campbell	CONUS Hospital	$47,946	455,469	$130	$59,211
61	Ireland Army Hospital, Ft. Knox	CONUS Hospital	$40,712	452,774	$130	$58,861
62	2nd Medical Group	CONUS Hospital	$16,904	123,004	$130	$15,991
64	Bayne-Jones Army Community Hospital, Ft. Polk	CONUS Hospital	$31,239	367,138	$130	$47,728
68	Naval Hospital, Patuxent River	CONUS Hospital	$10,666	49,863	$130	$6,482
69	Kimborough Army Hospital, Ft. Meade	CONUS Hospital	$34,348	168,694	$130	$21,930
72	410th Medical Group	CONUS Hospital	$8,965	119,588	$130	$15,546
74	14 FTW Hospital	CONUS Hospital	$6,591	65,523	$130	$8,518
75	Gen. Wood Army Hospital, Ft. Leonard Wood	CONUS Hospital	$45,369	472,762	$130	$61,459
76	95 1st Medical Group	CONUS Hospital	$9,147	100,078	$130	$13,010
78	Ehrling Berquist Strategic Hospital	CONUS Hospital	$25,164	234,610	$130	$30,499
79	554th Medical Group	CONUS Hospital	$20,479	362,764	$130	$47,159
81	Patterson Army Hospital, Ft. Monmouth	CONUS Hospital	$16,564	125,146	$130	$16,269
82	Walson Army Hospital, Ft. Dix	CONUS Hospital	$32,034	432,420	$130	$56,215
84	49th Medical Group	CONUS Hospital	$10,994	73,349	$130	$9,535
85	27th Medical Group	CONUS Hospital	$10,816	98,100	$130	$12,753
86	Keller Army Hospital, West Point	CONUS Hospital	$17,827	134,140	$130	$17,438
87	380th Medical Group	CONUS Hospital	$7,030	95,055	$130	$12,357
88	416th Medical Group	CONUS Hospital	$10,478	102,800	$130	$13,364
89	Womack Army Medical Center, Ft. Bragg	CONUS Hospital	$58,504	68,875	$130	$8,954
90	4th Medical Group	CONUS Hospital	$11,409	91,818	$130	$11,936
91	Naval Hospital, Camp Lejeune	CONUS Hospital	$43,866	424,025	$130	$55,123
92	Naval Hospital, Cherry Point	CONUS Hospital	$16,184	106,098	$130	$13,793
93	842nd Strategic Hospital	CONUS Hospital	$9,024	74,688	$130	$9,709

Table C-5. Data for Estimation of Alternative Construction-Cost Factor (Concluded)

DMIS ID	Facility Name	Facility Type	MEPRS Operating Cost (FY90 $K)	Square Footage Estimate	Construction Cost Per Square Foot	Estimated Construction Cost (FY90 $K)
94	5th Medical Group	CONUS Hospital	$12,775	178,000	$130	$23,140
96	USAF Hospital	CONUS Hospital	$12,284	154,850	$130	$20,131
97	443rd Medical Group	CONUS Hospital	$8,966	106,192	$130	$13,805
98	Reynolds Army Hospital, Ft. Sill	CONUS Hospital	$39,168	409,802	$130	$53,274
101	363rd Medical Group	CONUS Hospital	$14,164	100,551	$130	$13,072
103	Naval Hospital, Charleston	CONUS Hospital	$46,370	363,738	$130	$47,286
104	Naval Hospital, Beaufort	CONUS Hospital	$24,168	361,668	$130	$47,017
105	Moncrief Army Hospital, Ft. Jackson	CONUS Hospital	$35,327	330,077	$130	$42,910
106	812th Strategic Hospital	CONUS Hospital	$11,811	161,448	$130	$20,988
110	Darnall Hospital, Ft. Hood	CONUS Hospital	$63,374	504,202	$130	$65,546
111	64th FTW Hospital	CONUS Hospital	$7,238	60,628	$130	$7,882
112	96th Medical Group	CONUS Hospital	$12,272	141,462	$130	$18,390
11[illegible]	3750th Medical Group	CONUS Hospital	$27,503	306,454	$130	$39,839
114	47FTW Hospital	CONUS Hospital	$6,896	79,405	$130	$10,323
118	Naval Hospital, Corpus Christi	CONUS Hospital	$21,741	219,000	$130	$28,470
119	USAF Hospital Hill	CONUS Hospital	$12,405	95,430	$130	$12,406
120	1st Medical Group	CONUS Hospital	$25,760	124,801	$130	$16,224
121	McDonald Army Community Hospital, Ft. Eustis	CONUS Hospital	$21,060	140,120	$130	$18,216
122	Kenner Army Community Hospital, Ft. Lee	CONUS Hospital	$19,645	136,067	$130	$17,689
123	DeWitt Army Community Hospital, Ft. Belvoir	CONUS Hospital	$34,129	281,384	$130	$36,580
126	[illegible]l Hospital, Bremerton	CONUS Hospital	$35,982	252,700	$130	$32,851
127	[illegible] Hospital, Oak Harbor	CONUS Hospital	$10,679	104,738	$130	$13,616
128	[illegible]edical Group	CONUS Hospital	$16,086	128,685	$130	$16,729
129	9[illegible] Medical Group	CONUS Hospital	$8,424	91,191	$130	$11,855
131	Weed Army Community Hospital, Ft. Irwin	CONUS Hospital	$10,116	63,818	$130	$8,296

Annualized Construction Costs

The construction costs were annualized using a 3.8% discount rate and a 40-year facility lifetime. The annualized costs were then multiplied by $(1.038)^2$ to compensate for the interest income lost during the two-year lag time between the midpoint of construction and the opening of the facility. Next, separate regression analyses were performed for CONUS community hospitals and DoD medical centers. The dependent variable in each case was the annualized construction cost, and the independent variable was the total reported MEPRS inpatient and ambulatory operating expense. Figure C-3 presents a scatterplot of the data points for CONUS community hospitals, along with the fitted regression line.

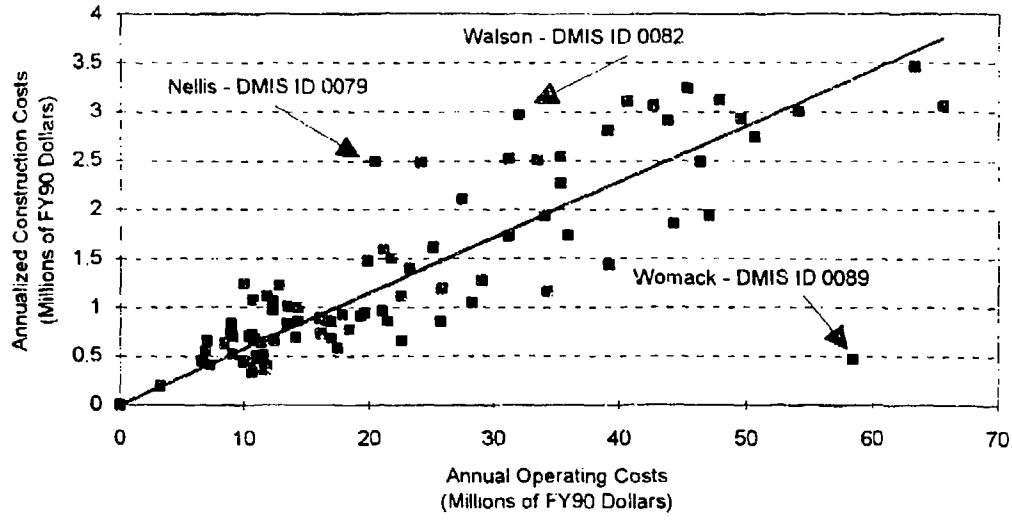

Figure C-3. Alternative Model, Annualized Construction Costs Versus Annual Operating Costs

Although initial regressions revealed a highly significant slope (i.e., variable-cost component), the intercept (i.e., fixed-cost component) was not statistically significant at the 95% confidence level for either facility type. The intercept was then eliminated and the regression analyses repeated. The new regression equations indicated the presence of one outlying medical center and three outlying community hospitals; the latter are highlighted in Figure C-3. The outliers were then eliminated from the dataset and the regressions again repeated. This process resulted in the following two models:

$CC = .0571 \times OC$ for CONUS community hospitals,

and

$CC = .0571 \times OC$ for DoD medical centers,

where:

CC = annualized construction cost, and

OC = annual operating costs.

Detailed regression results are shown in Table C-6. These results show a proportional relationship between annualized construction cost and annual operating costs, for both community hospitals and medical centers. It should be noted that the slope coefficients for community hospitals and medical centers are virtually identical, so the

resulting construction-cost factor need not be distinguished by facility type. Based on this approach, annualized construction costs represent 5.71% of operating costs. This figure is quite close to the earlier estimate of 5.84%, obtained after adjusting the economic analyses to reflect a 3.8% discount rate and a 40-year facility lifetime.

Table C-6. Regression Results for Alternative Construction-Cost Model (FY90 Dollars)

Facility Type:	CONUS Community Hospitals
Dependent Variable:	Annualized Construction Costs
Number of Observations:	84

Independent Variable	Coefficient	Standard Error	95% Confidence Band	R-Squared
Annual Operating Cost	0.05705	0.0015638	0.05394 to 0.06016	0.9413

Facility Type:	DoD Medical Centers
Dependent Variable:	Annualized Construction Costs
Number of Observations:	16

Independent Variable	Coefficient	Standard Error	95% Confidence Band	R-Squared
Annual Operating Cost	0.05715	0.0073184	0.04156 to 0.07275	0.8026

The regression models were tested for linearity by introducing terms for operating-cost squared. The squared term was not statistically significant for medical centers, but was highly significant for community hospitals. Statistical significance notwithstanding, the extremely small magnitude of the quadratic coefficient (-3.61×10^{-10}) made its inclusion in the model unnecessary.

Finally, Table C-7 shows the sensitivity of the construction-cost factor to changes in the discount rate and the facility lifetime. Once again, the construction-cost factor is quite sensitive to the choice of discount rate. For a fixed discount rate, however, the construction-cost factor is relatively insensitive to changes in the facility lifetime in the range between 25 and 50 years.

Table C-7. Sensitivity Analysis of Alternative Construction-Cost Factor (FY90 Dollars)

		Facility Lifetime									
		5	10	15	20	25	30	35	40	45	50
	2.0%	23.9%	12.5%	8.8%	6.9%	5.8%	5.0%	4.5%	4.1%	3.8%	3.6%
	2.5%	24.4%	13.0%	9.2%	7.3%	6.2%	5.4%	4.9%	4.5%	4.2%	4.0%
D	3.0%	25.0%	13.4%	9.6%	7.7%	6.6%	5.9%	5.3%	5.0%	4.7%	4.5%
i	3.5%	25.6%	13.9%	10.1%	8.1%	7.0%	6.3%	5.8%	5.4%	5.1%	4.9%
s	4.0%	26.3%	14.4%	10.5%	8.6%	7.5%	6.8%	6.3%	5.9%	5.6%	5.4%
c	4.5%	26.9%	14.9%	11.0%	9.1%	8.0%	7.2%	6.8%	6.4%	6.2%	6.0%
o	5.0%	27.5%	15.4%	11.5%	9.6%	8.5%	7.8%	7.3%	6.9%	6.7%	6.5%
u	5.5%	28.2%	16.0%	12.0%	10.1%	9.0%	8.3%	7.8%	7.5%	7.3%	7.1%
n	6.0%	28.8%	16.5%	12.5%	10.6%	9.5%	8.8%	8.4%	8.1%	7.9%	7.7%
t	6.5%	29.5%	17.1%	13.0%	11.1%	10.1%	9.4%	9.0%	8.7%	8.5%	8.3%
	7.0%	30.2%	17.6%	13.6%	11.7%	10.6%	10.0%	9.6%	9.3%	9.1%	9.0%
R	7.5%	30.9%	18.2%	14.2%	12.3%	11.2%	10.6%	10.2%	9.9%	9.7%	9.6%
a	8.0%	31.6%	18.8%	14.7%	12.8%	11.8%	11.2%	10.8%	10.6%	10.4%	10.3%
t	8.5%	32.3%	19.4%	15.3%	13.4%	12.4%	11.8%	11.5%	11.2%	11.1%	11.0%
e	9.0%	33.0%	20.0%	15.9%	14.1%	13.1%	12.5%	12.2%	11.9%	11.8%	11.7%
	9.5%	33.8%	20.6%	16.6%	14.7%	13.7%	13.2%	12.8%	12.6%	12.5%	12.4%
	10.0%	34.5%	21.3%	17.2%	15.4%	14.4%	13.9%	13.6%	13.4%	13.3%	13.2%

Note: This table represents annualized construction costs as a percentage of annual operating costs (at the margin). The calculations are based on the alternative construction-cost regression model (Table C-6), and all values are representative of FY90 costs for CONUS community hospitals.

SUMMARY

One final adjustment was made to arrive at our best estimates of the construction-cost factor. Recall that our second approach expressed annualized construction costs as a percentage of MEPRS post step-down inpatient ("A" account) plus ambulatory ("B" account) expenses. Similarly, our first approach used regression-based projections of operating costs in the same two MEPRS categories, conditional on expected utilization patterns. However, we now recognize that medical facilities support two additional final accounts in MEPRS, namely dental expenses ("C" account) and Special Programs ("F" account). Therefore, it is more appropriate to spread annualized construction costs over a broader base, including all four MEPRS final accounts: inpatient ("A"), ambulatory ("B"), dental ("C"), and Special Programs ("F").

This change was effected by multiplying our previous estimates of the construction-cost factor by the historical ratio of the subtotal in the inpatient and ambulatory accounts to the grand total in all four final accounts:

$$\text{New Construction - Cost Factor} = \frac{\text{Ann. construction costs}}{\text{MEPRS A + B + C + F}}$$

$$= \frac{\text{Ann. construction costs}}{\text{MEPRS A + B}} \times \frac{\text{MEPRS A + B}}{\text{MEPRS A + B + C + F}}$$

$$= \text{Old Construction - Cost Factor} \times \frac{\text{MEPRS A + B}}{\text{MEPRS A + B + C + F}}$$

The historical ratio equals 0.736. Therefore, our first approach yields a revised construction-cost factor of 4.3%, and our second approach yields a revised factor of 4.2%. For practical purposes, these two revised estimates are essentially identical.

APPENDIX D
DATA FOR INPATIENT REGRESSION MODEL

Table D-1. Data Used for Inpatient Regression Model

Facility Type	Service Branch	Fiscal Year	Observed Inpatient Expenses	Case-Mix Adjusted Discharges	Operating Beds	Residents plus Interns
Medical Center	Army	FY90	$74,434,312	15,746	348	20
Medical Center	Army	FY90	$103,802,720	22,076	421	197
Medical Center	Army	FY92	$88,543,888	21,285	421	197
Medical Center	Army	FY90	$185,550,912	36,249	731	524
Medical Center	Army	FY92	$194,361,632	37,289	731	427
Medical Center	Army	FY90	$76,515,632	17,396	360	120
Medical Center	Army	FY92	$69,765,424	17,646	360	120
Medical Center	Army	FY90	$126,957,272	23,013	408	198
Medical Center	Army	FY92	$113,279,024	24,589	408	198
Medical Center	Army	FY90	$87,661,056	17,647	340	137
Medical Center	Army	FY92	$77,[illegible]2,664	18,089	340	127
Medical Center	Army	FY90	$88,562,128	20,873	265	201
Medical Center	Army	FY92	$113,882,304	21,272	265	[illegible]4
Medical Center	Navy	FY90	$69,759,584	10,445	225	147
Medical Center	Navy	FY92	$70,763,848	11,574	225	72
Medical Center	Navy	FY90	$128,864,936	28,511	393	339
Medical Center	Navy	FY92	$135,364,208	27,748	393	298
Medical Center	Navy	FY90	$77,251,328	18,310	427	256
Medical Center	Navy	FY92	$114,249,048	18,454	427	217
Medical Center	Navy	FY90	$125,307,656	24,977	446	196
Medical Center	Navy	FY92	$102,634,072	24,225	446	190
Medical Center	Air Force	FY90	$65,523,312	12,193	220	104
Medical Center	Air Force	FY92	$60,466,948	13,121	220	103
Medical Center	Air Force	FY90	$30,044,490	6,374	115	25
Medical Center	Air Force	FY92	$29,678,094	6,580	115	25
Medical Center	Air Force	FY90	$46,213,116	9,035	210	37
Medical Center	Air Force	FY92	$42,622,944	9,195	210	37
Medical Center	Air Force	FY90	$70,494,648	12,916	255	88
Medical Center	Air Force	FY92	$62,534,312	13,447	255	88
Medical Center	Air Force	FY90	$65,296,636	10,931	225	109
Medical Center	Air Force	FY92	$59,296,752	10,365	225	109
Medical Center	Air Force	FY90	$114,737,240	26,108	399	273
Medical Center	Air Force	FY92	$104,976,816	26,374	399	273
Medical Center	Air Force	FY90	$160,614,080	35,890	1,000	375
Medical Center	Air Force	FY92	$178,268,992	32,806	1,000	395
Community Hospital	Army	FY90	$7,294,689	1,648	26	0
Community Hospital	Army	FY92	$6,128,095	1,590	26	0
Community Hospital	Army	FY90	$10,429,531	2,959	39	0
Community Hospital	Army	FY92	$10,425,443	2,678	39	0
Community Hospital	Army	FY90	$10,593,929	2,805	38	0
Community Hospital	Army	FY92	$11,908,230	3,636	38	0
Community Hos[illegible]	Army	FY90	$13,028,491	2,292	30	0
Community Hospital	Army	FY92	$10,605,005	2,044	30	0
Community Hospital	Army	FY90	$10,244,474	2,574	42	0
Community Hospital	Army	FY92	$10,747,756	2,736	42	0

Table D-1. Data Used for Inpatient Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Inpatient Expenses	Case-Mix Adjusted Discharges	Operating Beds	Residents plus Interns
Community Hospital	Army	FY90	$27,153,098	6,971	113	19
Community Hospital	Army	FY92	$23,451,206	6,253	113	19
Community Hospital	Army	FY90	$28,841,680	7,027	113	0
Community Hospital	Army	FY92	$29,593,974	7,301	113	0
Community Hospital	Army	FY90	$33,096,860	9,880	171	36
Community Hospital	Army	FY92	$31,068,630	8,490	171	36
Community Hospital	Army	FY90	$19,827,990	4,217	73	0
Community Hospital	Army	FY92	$23,462,782	5,140	73	0
Community Hospital	Army	FY90	$18,775,490	4,876	89	0
Community Hospital	Army	FY92	$16,336,463	4,418	89	0
Community Hospital	Army	FY90	$8,494,489	1,569	18	0
Community Hospital	Army	FY92	$5,977,384	1,369	18	0
Community Hospital	Army	FY90	$25,860,008	7,735	120	0
Community Hospital	Army	FY92	$25,978,298	7,952	120	0
Community Hospital	Army	FY90	$23,549,760	6,282	112	0
Community Hospital	Army	FY92	$22,343,868	5,386	112	0
Community Hospital	Army	FY90	$19,520,390	4,482	70	0
Community Hospital	Army	FY92	$18,062,810	4,152	70	0
Community Hospital	Army	FY90	$10,691,710	3,655	50	0
Community Hospital	Army	FY92	$14,673,953	3,374	50	0
Community Hospital	Army	FY90	$24,383,172	6,708	142	0
Community Hospital	Army	FY92	$19,753,226	5,314	142	0
Community Hospital	Army	FY90	$5,867,696	1,151	18	0
Community Hospital	Army	FY92	$5,103,039	1,332	18	0
Community Hospital	Army	FY90	$17,835,806	3,698	36	0
Community Hospital	Army	FY92	$11,714,777	2,666	36	0
Community Hospital	Army	FY90	$10,517,582	3,240	48	0
Community Hospital	Army	FY92	$10,234,326	2,563	48	0
Community Hospital	Army	FY90	$20,861,746	6,143	112	0
Community Hospital	Army	FY92	$20,227,844	5,712	112	0
Community Hospital	Army	FY90	$20,787,730	7,147	132	0
Community Hospital	Army	FY92	$20,487,706	7,599	132	0
Community Hospital	Army	FY90	$37,733,828	11,867	126	25
Community Hospital	Army	FY92	$36,343,936	10,945	126	25
Community Hospital	Army	FY90	$9,731,563	2,835	42	0
Community Hospital	Army	FY92	$10,318,345	2,982	42	0
Community Hospital	Army	FY90	$9,464,417	3,302	52	0
Community Hospital	Army	FY92	$9,429,630	3,183	52	0
Community Hospital	Army	FY90	$19,788,916	4,869	63	18
Community Hospital	Army	FY92	$18,140,456	5,104	63	18
Community Hospital	Army	FY90	$5,305,662	914	12	0
Community Hospital	Army	FY92	$5,736,818	1,375	12	0
Community Hospital	Army	FY90	$3,319,261	753	8	0
Community Hospital	Army	FY92	$3,102,893	611	8	0

Table D-1. Data Used for Inpatient Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Inpatient Expenses	Case-Mix Adjusted Discharges	Operating Beds	Residents plus Interns
Community Hospital	Navy	FY90	$1,[illegible]9,538	45	4	0
Community Hospital	Navy	FY90	$29,829,546	[illegible],510	128	37
Community Hospital	Navy	FY92	$27,745,206	6,057	128	30
Community Hospital	Navy	FY90	$19,680,599	3,820	166	0
Community Hospital	Navy	FY92	$18,126,260	2,848	166	0
Community Hospital	Navy	FY90	$4,247,922	801	37	0
Community Hospital	Navy	FY92	$5,710,161	771	37	0
Community Hospital	Navy	FY90	$4,913,480	1,099	40	0
Community Hospital	Navy	FY92	$4,902,345	1,375	40	0
Community Hospital	Navy	FY90	$9,034,470	1,474	25	0
Community Hospital	Navy	FY92	$7,481,128	1,801	25	0
Community Hospital	Navy	FY90	$24,526,164	4,867	104	40
Community Hospital	Navy	FY92	$20,[illegible]8,306	4,735	104	35
Community Hospital	Navy	FY90	$36,385,872	8,115	131	39
Community Hospital	Navy	FY92	$30,335,8[illegible]	6,63[illegible]	131	34
Community Hospital	Navy	FY90	$19,622,514	5,019	143	0
Community Hospital	Navy	FY92	$16,647,701	3,922	143	0
Community Hospital	Navy	FY90	$21,820,140	4,032	136	0
Community Hospital	Navy	FY92	$20,751,558	3,686	136	0
Community Hospital	Navy	FY90	$4,739,947	579	20	0
Community Hospital	Navy	FY92	$4,737,232	553	20	0
Community Hospital	Navy	FY90	$26,074,588	6,578	136	0
Community Hospital	Navy	FY92	$24,700,424	6,[illegible]59	136	0
Community Hospital	Navy	FY90	$7,286,338	1,298	43	0
Community Hospital	Navy	FY92	$6,142,432	1,039	43	0
Community Hospital	Navy	FY90	$10,374,535	2,041	106	0
Community Hospital	Navy	FY90	$28,852,294	7,609	181	37
Community Hospital	Navy	FY92	$25,564,492	7,438	181	27
Community Hospital	Navy	FY90	$9,672,552	1,758	49	0
Community Hospital	Navy	FY92	$8,968,900	1,626	49	0
Community Hospital	Navy	FY90	$13,137,833	2,312	66	0
Community Hospital	Navy	FY92	$10,999,201	2,003	66	0
Community Hospital	Navy	FY90	$9,145,707	1,504	42	0
Community Hospital	Navy	FY92	$7,411,651	1,309	42	0
Community Hospital	Navy	FY90	$20,739,222	3,579	109	14
Community Hospital	Navy	FY92	$18,324,964	4,656	109	6
Community Hospital	Navy	FY90	$5,329,477	1,023	25	0
Community Hospital	Navy	FY92	$5,173,048	1,212	25	0
Community Hospital	Air Force	FY90	$7,704,933	2,873	55	0
Community Hospital	Air Force	FY92	$11,535,361	3,911	55	0
Community Hospital	Air Force	FY90	$19,371,264	3,750	70	0
Community Hospital	Air Force	FY92	$19,309,478	4,152	70	0
Community Hospital	Air Force	FY90	$10,723,105	2,463	55	0
Community Hospital	Air Force	FY92	$12,686,340	2,959	55	0
Community Hospital	Air Force	FY90	$9,477,326	2,102	35	0
Community Hospital	Air Force	FY92	$8,181,842	2,293	35	0
Community Hospital	Air Force	FY90	$5,610,043	1,316	9	0

Table D-1. Data Used for Inpatient Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Inpatient Expenses	Case-Mix Adjusted Discharges	Operating Beds	Residents plus Interns
Community Hospital	Air Force	FY92	$4,190,750	1,118	9	0
Community Hospital	Air Force	FY90	$4,721,323	968	15	0
Community Hospital	Air Force	FY92	$4,444,754	891	15	0
Community Hospital	Air Force	FY90	$10,765,022	2,013	35	0
Community Hospital	Air Force	FY92	$9,590,558	2,363	35	0
Community Hospital	Air Force	FY90	$4,119,054	1,043	25	0
Community Hospital	Air Force	FY92	$2,705,368	586	25	0
Community Hospital	Air Force	FY90	$6,621,439	1,263	20	0
Community Hospital	Air Force	FY92	$5,390,760	1,443	20	0
Community Hospital	Air Force	FY90	$4,715,812	841	15	0
Community Hospital	Air Force	FY92	$5,200,853	778	15	0
Community Hospital	Air Force	FY90	$16,435,677	2,710	80	0
Community Hospital	Air Force	FY92	$16,591,917	3,927	80	0
Community Hospital	Air Force	FY90	$14,222,644	3,324	65	0
Community Hospital	Air Force	FY92	$14,938,891	5,544	65	0
Community Hospital	Air Force	FY90	$4,181,997	784	20	0
Community Hospital	Air Force	FY92	$4,070,628	1,105	20	0
Community Hospital	Air Force	FY90	$24,838,608	6,716	120	17
Community Hospital	Air Force	FY92	$24,308,004	5,858	120	17
Community Hospital	Air Force	FY90	$8,078,198	1,548	35	0
Community Hospital	Air Force	FY92	$8,999,283	2,275	35	0
Community Hospital	Air Force	FY90	$13,501,520	3,154	55	0
Community Hospital	Air Force	FY92	$14,087,715	3,675	55	0
Community Hospital	Air Force	FY90	$2,634,710	683	15	0
Community Hospital	Air Force	FY92	$3,793,668	1,044	15	0
Community Hospital	Air Force	FY90	$5,046,805	937	20	0
Community Hospital	Air Force	FY92	$4,791,796	756	20	0
Community Hospital	Air Force	FY90	$5,093,360	1,000	20	0
Community Hospital	Air Force	FY92	$4,620,479	853	20	0
Community Hospital	Air Force	FY90	$4,524,805	1,192	20	0
Community Hospital	Air Force	FY92	$5,728,855	1,268	20	0
Community Hospital	Air Force	FY90	$3,527,138	875	30	0
Community Hospital	Air Force	FY92	$2,814,787	699	30	0
Community Hospital	Air Force	FY90	$8,986,475	2,279	35	0
Community Hospital	Air Force	FY92	$8,205,968	2,013	35	0
Community Hospital	Air Force	FY90	$3,650,226	868	20	0
Community Hospital	Air Force	FY92	$3,986,493	726	20	0
Community Hospital	Air Force	FY90	$4,262,774	999	15	0
Community Hospital	Air Force	FY92	$2,691,805	448	15	0
Community Hospital	Air Force	FY90	$4,221,730	755	15	0
Community Hospital	Air Force	FY92	$3,971,655	715	15	0
Community Hospital	Air Force	FY90	$2,774,691	503	7	0
Community Hospital	Air Force	FY92	$2,342,219	458	7	0
Community Hospital	Air Force	FY90	$4,418,105	1,116	15	0
Community Hospital	Air Force	FY92	$4,481,042	950	15	0

Table D-1. Data Used for Inpatient Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Inpatient Expenses	Case-Mix Adjusted Discharges	Operating Beds	Residents plus Interns
Community Hospital	Air Force	FY90	$11,684,332	3,661	50	0
Community Hospital	Air Force	FY92	$13,036,695	3,468	50	6
Community Hospital	Air Force	FY90	$6,970,945	1,981	35	0
Community Hospital	Air Force	FY92	$8,237,294	1,655	35	0
Community Hospital	Air Force	FY90	$5,984,924	2,076	40	0
Community Hospital	Air Force	FY92	$8,821,379	1,840	40	0
Community Hospital	Air Force	FY90	$4,811,392	929	20	0
Community Hospital	Air Force	FY92	$4,229,538	983	20	0
Community Hospital	Air Force	FY90	$5,451,846	1,159	20	0
Community Hospital	Air Force	FY92	$5,411,808	1,157	20	0
Community Hospital	Air Force	FY90	$2,164,133	384	5	0
Community Hospital	Air Force	FY92	$2,010,486	318	5	0
Community Hospital	Air Force	FY90	$4,616,927	820	15	0
Community Hospital	Air Force	FY92	$4,240,088	777	15	0
Community Hospital	Air Force	FY90	$3,930,64	848	20	0
Community Hospital	Air Force	FY92	$4,485,907	958	20	0
Community Hospital	Air Force	FY90	$4,568,587	1,196	15	0
Community Hospital	Air Force	FY92	$4,501,338	949	15	0
Community Hospital	Air Force	FY90	$7,058,443	1,716	30	0
Community Hospital	Air Force	FY92	$8,152,998	1,718	30	0
Community Hospital	Air Force	FY90	$3,934,306	1,894	25	0
Community Hospital	Air Force	FY92	$6,593,816	1,214	25	0
Community Hospital	Air Force	FY90	$4,685,502	824	15	0
Community Hospital	Air Force	FY92	$4,069,426	706	15	0
Community Hospital	Air Force	FY90	$6,004,132	1,278	30	0
Community Hospital	Air Force	FY92	$6,467,476	1,587	30	0
Community Hospital	Air Force	FY90	$6,205,935	1,714	25	0
Community Hospital	Air Force	FY92	$6,040,061	1,469	25	0
Community Hospital	Air Force	FY90	$2,292,617	247	5	0
Community Hospital	Air Force	FY92	$2,270,437	330	5	0
Community Hospital	Air Force	FY90	$5,806,051	1,349	20	0
Community Hospital	Air Force	FY92	$5,191,437	1,142	20	0
Community Hospital	Air Force	FY90	$3,687,275	415	7	0
Community Hospital	Air Force	FY92	$3,746,266	475	7	0
Community Hospital	Air Force	FY90	$4,158,884	1,121	30	0
Community Hospital	Air Force	FY92	$3,597,211	956	30	0
Community Hospital	Air Force	FY90	$22,042,348	5,748	100	23
Community Hospital	Air Force	FY92	$17,446,320	3,901	100	23
Community Hospital	Air Force	FY90	$5,502,384	1,505	20	0
Community Hospital	Air Force	FY92	$5,973,954	1,626	20	0
Community Hospital	Air Force	FY90	$10,973,050	2,130	70	0
Community Hospital	Air Force	FY92	$15,191,572	2,885	70	0
Community Hospital	Air Force	FY90	$8,338,173	2,332	30	0
Community Hospital	Air Force	FY92	$7,608,877	1,858	30	0
Community Hospital	Air Force	FY90	$4,033,270	1,186	20	0
Community Hospital	Air Force	FY92	$4,128,731	1,039	20	0

APPENDIX E
DATA FOR AMBULATORY REGRESSION MODEL

Table E-1. Data Used for Ambulatory Regression Model

Facility Type	Service Branch	Fiscal Year	Observed Ambulatory Expenses	Total Visits	Residents plus Interns
Medical Center	Army	FY90	$52,107,120	477,363	20
Medical Center	Army	FY92	$33,827,692	269,674	0
Medical Center	Army	FY90	$59,965,288	666,728	197
Medical Center	Army	FY92	$67,948,984	711,912	197
Medical Center	Army	FY90	$120,958,288	1,030,000	524
Medical Center	Army	FY92	$114,611,728	1,027,586	427
Medical Center	Army	FY90	$67,106,552	568,167	120
Medical Center	Army	FY92	$67,070,548	589,794	120
Medical Center	Army	FY90	$84,395,680	825,533	198
Medical Center	Army	FY92	$77,562,944	899,489	198
Medical Center	Army	FY90	$60,134,316	731,348	137
Medical Center	Army	FY92	$57,527,648	789,222	127
Medical Center	Army	FY90	$69,253,936	910,164	201
Medical Center	Army	FY92	$87,899,904	917,130	194
Medical Center	Navy	FY90	$68,927,192	489,081	147
Medical Center	Navy	FY92	$76,002,112	511,902	72
Medical Center	Navy	FY90	$127,805,312	1,168,376	339
Medical Center	Navy	FY92	$112,763,592	1,094,323	298
Medical Center	Navy	FY90	$68,936,192	565,293	256
Medical Center	Navy	FY92	$112,000,392	622,077	217
Medical Center	Navy	FY90	$114,609,712	1,164,750	196
Medical Center	Navy	FY92	$102,181,888	1,239,082	190
Medical Center	Air Force	FY90	$41,611,048	347,689	104
Medical Center	Air Force	FY92	$39,381,360	363,764	103
Medical Center	Air Force	FY90	$30,211,866	294,761	25
Medical Center	Air Force	FY92	$35,306,900	295,541	25
Medical Center	Air Force	FY90	$49,142,460	422,132	37
Medical Center	Air Force	FY92	$44,609,264	451,423	37
Medical Center	Air Force	FY90	$43,064,376	393,367	88
Medical Center	Air Force	FY92	$45,970,704	416,642	88
Medical Center	Air Force	FY90	$52,377,508	455,831	109
Medical Center	Air Force	FY92	$55,766,084	458,777	109
Medical Center	Air Force	FY90	$77,293,120	823,006	273
Medical Center	Air Force	FY92	$67,299,248	881,658	273
Medical Center	Air Force	FY90	$97,741,040	957,478	375
Medical Center	Air Force	FY92	$106,157,952	933,991	395
Community Hospital	Army	FY90	$13,544,732	132,964	0
Community Hospital	Army	FY92	$11,128,092	142,246	0
Community Hospital	Army	FY90	$18,487,456	195,414	0
Community Hospital	Army	FY92	$17,035,042	180,425	0
Community Hospital	Army	FY90	$18,976,804	205,913	0
Community Hospital	Army	FY92	$20,101,812	222,310	0
Community Hospital	Army	FY90	$19,810,768	206,777	0

Table E-1. Data Used for Ambulatory Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Ambulatory Expenses	Total Visits	Residents plus Interns
Community Hospital	Army	FY92	$20,534,620	206,261	0
Community Hospital	Army	FY90	$15,771,225	193,747	0
Community Hospital	Army	FY92	$18,393,772	195,523	0
Community Hospital	Army	FY90	$33,850,672	418,435	19
Community Hospital	Army	FY92	$31,119,546	413,770	19
Community Hospital	Army	FY90	$42,304,732	503,735	0
Community Hospital	Army	FY92	$43,336,736	569,833	0
Community Hospital	Army	FY90	$42,341,068	551,003	36
Community Hospital	Army	FY92	$45,605,392	586,128	36
Community Hospital	Army	FY90	$29,634,504	330,391	0
Community Hospital	Army	FY92	$32,739,316	386,398	0
Community Hospital	Army	FY90	$28,195,416	421,836	0
Community Hospital	Army	FY92	$27,027,854	376,366	0
Community Hospital	Army	FY90	$15,296,717	210,947	0
Community Hospital	Army	FY92	$15,893,734	164,933	0
Community Hospital	Army	FY90	$41,460,280	645,833	0
Community Hospital	Army	FY92	$39,300,280	667,139	0
Community Hospital	Army	FY90	$33,910,720	477,015	0
Community Hospital	Army	FY92	$37,624,680	507,451	0
Community Hospital	Army	FY90	$24,066,822	303,694	0
Community Hospital	Army	FY92	$25,285,678	371,681	0
Community Hospital	Army	FY90	$40,070,940	506,134	0
Community Hospital	Army	FY92	$51,058,376	538,835	0
Community Hospital	Army	FY90	$16,987,788	173,437	0
Community Hospital	Army	FY92	$15,597,591	162,723	0
Community Hospital	Army	FY90	$41,366,200	525,713	0
Community Hospital	Army	FY92	$36,597,656	533,383	0
Community Hospital	Army	FY90	$18,650,260	160,640	0
Community Hospital	Army	FY92	$15,445,346	169,520	0
Community Hospital	Army	FY90	$27,263,356	297,035	0
Community Hospital	Army	FY92	$16,081,818	171,628	0
Community Hospital	Army	FY90	$14,428,182	159,463	0
Community Hospital	Army	FY92	$14,737,266	150,702	0
Community Hospital	Army	FY90	$48,086,524	831,856	35
Community Hospital	Army	FY92	$50,596,000	882,467	35
Community Hospital	Army	FY90	$34,201,912	459,267	0
Community Hospital	Army	FY92	$36,909,028	501,071	0
Community Hospital	Army	FY90	$28,449,194	368,761	0
Community Hospital	Army	FY92	$30,098,956	380,284	0
Community Hospital	Army	FY90	$51,979,408	731,151	25
Community Hospital	Army	FY92	$40,599,208	669,959	25
Community Hospital	Army	FY90	$19,767,300	290,023	0
Community Hospital	Army	FY92	$18,527,654	315,488	0

Table E-1. Data Used for Ambulatory Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Ambulatory Expense	Total Visits	Residents plus Interns
Community Hospital	Army	FY90	$18,541,446	198,361	0
Community Hospital	Army	FY92	$17,551,966	220,553	0
Community Hospital	Army	FY90	$27,882,848	347,619	18
Community Hospital	Army	FY92	$28,662,426	374,429	18
Community Hospital	Army	FY90	$8,908,706	99,025	0
Community Hospital	Army	FY92	$8,858,634	108,630	0
Community Hospital	Army	FY90	$8,760,310	107,195	0
Community Hospital	Army	FY92	$7,822,539	100,758	0
Community Hospital	Navy	FY90	$2,837,061	42,448	0
Community Hospital	Navy	FY92	$2,366,816	30,429	0
Community Hospital	Navy	FY90	$38,770,836	407,972	37
Community Hospital	Navy	FY92	$50,593,268	495,364	30
Community Hospital	Navy	FY90	$38,959,024	281,865	0
Community Hospital	Navy	FY92	$33,506,952	209,597	0
Community Hospital	Navy	FY90	$11,700,649	108,205	0
Community Hospital	Navy	FY92	$13,508,859	152,012	0
Community Hospital	Navy	FY90	$8,987,172	129,213	0
Community Hospital	Navy	FY92	$8,610,120	100,593	0
Community Hospital	Navy	FY90	$22,437,672	187,443	0
Community Hospital	Navy	FY92	$19,923,054	213,594	0
Community Hospital	Navy	FY90	$40,409,376	404,061	40
Community Hospital	Navy	FY92	$39,043,172	350,755	35
Community Hospital	Navy	FY90	$54,421,980	489,645	39
Community Hospital	Navy	FY92	$54,194,936	502,202	34
Community Hospital	Navy	FY90	$34,344,648	430,893	0
Community Hospital	Navy	FY92	$29,847,436	382,078	0
Community Hospital	Navy	FY90	$36,266,828	469,425	0
Community Hospital	Navy	FY92	$36,564,996	346,481	0
Community Hospital	Navy	FY90	$10,259,392	85,851	0
Community Hospital	Navy	FY92	$13,649,075	80,825	0
Community Hospital	Navy	FY90	$33,700,912	379,603	0
Community Hospital	Navy	FY92	$31,060,550	421,214	0
Community Hospital	Navy	FY90	$15,870,213	162,897	0
Community Hospital	Navy	FY92	$11,436,047	167,259	0
Community Hospital	Navy	FY90	$20,423,248	144,897	0
Community Hospital	Navy	FY92	$21,392,576	173,886	0
Community Hospital	Navy	FY90	$35,933,264	359,006	37
Community Hospital	Navy	FY92	$36,319,608	371,356	27
Community Hospital	Navy	FY90	$24,122,366	268,392	0
Community Hospital	Navy	FY92	$20,821,628	265,150	0
Community Hospital	Navy	FY90	$24,198,176	183,946	0
Community Hospital	Navy	FY92	$21,980,022	189,565	0
Community Hospital	Navy	FY90	$20,884,026	133,546	0
Community Hospital	Navy	FY92	$18,664,334	139,003	0

Table E-1. Data Used for Ambulatory Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Ambulatory Expenses	Total Visits	Residents plus Interns
Community Hospital	Navy	FY90	$30,954,972	374,416	14
Community Hospital	Navy	FY92	$33,049,012	377,536	6
Community Hospital	Navy	FY90	$9,596,663	119,600	0
Community Hospital	Navy	FY92	$13,011,474	142,445	0
Community Hospital	Air Force	FY90	$10,270,624	210,323	0
Community Hospital	Air Force	FY92	$18,034,624	209,188	0
Community Hospital	Air Force	FY90	$22,484,266	231,301	0
Community Hospital	Air Force	FY92	$25,785,852	253,846	0
Community Hospital	Air Force	FY90	$18,217,202	224,555	0
Community Hospital	Air Force	FY92	$21,643,008	231,563	0
Community Hospital	Air Force	FY90	$21,096,726	206,873	0
Community Hospital	Air Force	FY92	$17,851,022	207,227	0
Community Hospital	Air Force	FY90	$13,811,203	151,819	0
Community Hospital	Air Force	FY92	$13,658,043	160,029	0
Community Hospital	Air Force	FY90	$8,707,413	83,729	0
Community Hospital	Air Force	FY92	$9,156,479	89,090	0
Community Hospital	Air Force	FY90	$15,250,582	155,683	0
Community Hospital	Air Force	FY92	$17,586,104	160,001	0
Community Hospital	Air Force	FY90	$8,943,351	134,646	0
Community Hospital	Air Force	FY92	$9,729,978	113,527	0
Community Hospital	Air Force	FY90	$11,476,412	121,789	0
Community Hospital	Air Force	FY92	$11,813,377	139,939	0
Community Hospital	Air Force	FY90	$9,391,255	114,495	0
Community Hospital	Air Force	FY92	$9,652,935	115,555	0
Community Hospital	Air Force	FY90	$18,278,188	197,344	0
Community Hospital	Air Force	FY92	$16,781,518	206,701	0
Community Hospital	Air Force	FY90	$23,880,722	242,950	0
Community Hospital	Air Force	FY92	$24,525,222	255,716	0
Community Hospital	Air Force	FY90	$7,988,887	121,295	0
Community Hospital	Air Force	FY92	$9,665,995	142,306	0
Community Hospital	Air Force	FY90	$34,759,488	368,020	17
Community Hospital	Air Force	FY92	$37,194,660	377,839	17
Community Hospital	Air Force	FY90	$15,471,893	129,764	0
Community Hospital	Air Force	FY92	$14,892,206	138,053	0
Community Hospital	Air Force	FY90	$25,704,304	258,824	0
Community Hospital	Air Force	FY92	$27,003,394	261,320	0
Community Hospital	Air Force	FY90	$12,934,948	115,402	0
Community Hospital	Air Force	FY92	$14,300,167	127,452	0
Community Hospital	Air Force	FY90	$10,821,056	95,879	0
Community Hospital	Air Force	FY92	$11,086,385	101,266	0
Community Hospital	Air Force	FY90	$11,035,723	128,925	0
Community Hospital	Air Force	FY92	$12,631,415	136,909	0
Community Hospital	Air Force	FY90	$9,986,087	106,268	0
Community Hospital	Air Force	FY92	$10,545,803	101,718	0

Table E-1. Data Used for Ambulatory Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Ambulatory Expenses	Total Visits	Residents plus Interns
Community Hospital	Air Force	FY90	$9,813,223	114,080	0
Community Hospital	Air Force	FY92	$8,345,819	86,272	0
Community Hospital	Air Force	FY90	$13,770,716	187,016	0
Community Hospital	Air Force	FY92	$14,491,033	179,639	0
Community Hospital	Air Force	FY90	$5,967,135	69,876	0
Community Hospital	Air Force	FY92	$6,197,658	68,324	0
Community Hospital	Air Force	FY90	$7,197,368	84,487	0
Community Hospital	Air Force	FY92	$6,742,486	68,755	0
Community Hospital	Air Force	FY90	$7,868,090	88,446	0
Community Hospital	Air Force	FY92	$7,494,509	81,612	0
Community Hospital	Air Force	FY90	$6,126,143	56,405	0
Community Hospital	Air Force	FY92	$6,078,302	57,451	0
Community Hospital	Air Force	FY90	$7,913,319	98,378	0
Community Hospital	Air Force	FY92	$8,851,166	97,215	0
Community Hospital	Air Force	FY90	$22,258,158	277,216	6
Community Hospital	Air Force	FY92	$23,649,066	281,074	6
Community Hospital	Air Force	FY90	$20,748,568	227,023	0
Community Hospital	Air Force	FY92	$21,006,348	234,302	0
Community Hospital	Air Force	FY90	$11,266,732	105,758	0
Community Hospital	Air Force	FY90	$15,670,395	175,676	0
Community Hospital	Air Force	FY92	$17,172,900	186,277	0
Community Hospital	Air Force	FY90	$10,029,054	120,677	0
Community Hospital	Air Force	FY92	$12,101,683	116,534	0
Community Hospital	Air Force	FY90	$9,121,634	98,914	0
Community Hospital	Air Force	FY92	$10,699,303	117,418	0
Community Hospital	Air Force	FY90	$7,360,494	77,203	0
Community Hospital	Air Force	FY92	$7,361,229	69,170	0
Community Hospital	Air Force	FY90	$9,525,527	101,184	0
Community Hospital	Air Force	FY92	$9,594,506	118,108	0
Community Hospital	Air Force	FY90	$11,509,927	128,783	0
Community Hospital	Air Force	FY92	$13,913,386	140,656	0
Community Hospital	Air Force	FY90	$7,588,485	98,995	0
Community Hospital	Air Force	FY92	$8,729,040	105,111	0
Community Hospital	Air Force	FY90	$10,130,415	113,573	0
Community Hospital	Air Force	FY92	$10,790,335	115,486	0
Community Hospital	Air Force	FY90	$13,875,480	224,383	0
Community Hospital	Air Force	FY92	$19,487,286	217,834	0
Community Hospital	Air Force	FY90	$7,388,611	70,138	0
Community Hospital	Air Force	FY92	$7,492,849	77,101	0
Community Hospital	Air Force	FY90	$13,122,908	133,666	0
Community Hospital	Air Force	FY92	$14,572,450	176,379	0
Community Hospital	Air Force	FY90	$8,976,990	84,363	0
Community Hospital	Air Force	FY92	$8,655,669	84,195	0
Community Hospital	Air Force	FY90	$9,697,579	139,044	0

Table E-1. Data Used for Ambulatory Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Ambulatory Expenses	Total Visits	Residents plus Interns
Community Hospital	Air Force	FY92	$10,081,659	138,786	0
Community Hospital	Air Force	FY90	$7,510,433	59,618	0
Community Hospital	Air Force	FY92	$6,674,853	56,907	0
Community Hospital	Air Force	FY90	$10,742,311	125,467	0
Community Hospital	Air Force	FY92	$11,490,849	128,522	0
Community Hospital	Air Force	FY90	$5,595,826	50,787	0
Community Hospital	Air Force	FY92	$5,786,481	45,459	0
Community Hospital	Air Force	FY90	$15,104,660	139,782	0
Community Hospital	Air Force	FY92	$12,422,906	136,160	0
Community Hospital	Air Force	FY90	$29,222,758	288,231	23
Community Hospital	Air Force	FY92	$27,366,678	246,450	23
Community Hospital	Air Force	FY90	$12,271,935	159,249	0
Community Hospital	Air Force	FY92	$13,049,740	171,100	0
Community Hospital	Air Force	FY90	$23,810,858	283,072	0
Community Hospital	Air Force	FY92	$28,088,238	276,128	0
Community Hospital	Air Force	FY90	$13,326,308	153,328	0
Community Hospital	Air Force	FY92	$12,834,950	138,620	0
Community Hospital	Air Force	FY90	$7,335,154	95,000	0
Community Hospital	Air Force	FY92	$7,781,265	80,104	0
Clinic	Army	FY90	$17,513,274	187,553	0
Clinic	Army	FY92	$21,516,966	237,564	0
Clinic	Army	FY90	$4,327,862	35,259	0
Clinic	Army	FY92	$3,453,514	28,164	0
Clinic	Navy	FY90	$2,923,899	105,748	0
Clinic	Navy	FY92	$573,490	112,036	0
Clinic	Navy	FY90	$4,448,361	41,227	0
Clinic	Navy	FY92	$5,048,686	39,045	0
Clinic	Navy	FY90	$38,307,652	297,352	0
Clinic	Navy	FY92	$22,542,246	331,176	0
Clinic	Navy	FY90	$5,598,707	43,814	0
Clinic	Navy	FY92	$5,548,504	43,620	0
Clinic	Navy	FY90	$11,915,566	100,596	0
Clinic	Navy	FY92	$11,655,670	128,064	0
Clinic	Navy	FY90	$5,743,466	71,258	0
Clinic	Navy	FY92	$3,008,637	69,117	0
Clinic	Navy	FY90	$13,669,860	120,250	0
Clinic	Navy	FY92	$13,227,803	133,000	0
Clinic	Navy	FY90	$2,526,169	32,949	0
Clinic	Navy	FY92	$4,103,755	34,134	0
Clinic	Navy	FY90	$3,427,097	38,846	0
Clinic	Navy	FY92	$4,907,769	31,418	0

Table E-1. Data Used for Ambulatory Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Ambulatory Expenses	Total Visits	Residents plus Interns
Clinic	Air Force	FY90	$8,179,521	84,887	0
Clinic	Air Force	FY92	$9,008,053	92,345	0
Clinic	Air Force	FY90	$5,389,040	57,968	0
Clinic	Air Force	FY92	$2,959,867	58,397	0
Clinic	Air Force	FY90	$4,010,303	31,421	0
Clinic	Air Force	FY92	$3,527,752	30,875	0
Clinic	Air Force	FY90	$8,441,241	85,653	0
Clinic	Air Force	FY92	$6,130,879	72,257	0
Clinic	Air Force	FY90	$8,556,385	105,957	0
Clinic	Air Force	FY92	$9,238,621	118,384	0
Clinic	Air Force	FY90	$3,463,059	36,962	0
Clinic	Air Force	FY92	$2,882,225	33,824	0
Clinic	Air Force	FY90	$8,185,738	110,316	0
Clinic	Air Force	FY92	$8,729,813	114,628	0
Clinic	Air Force	FY90	$7,457,530	99,330	0
Clinic	Air Force	FY92	$7,926,434	93,029	0
Clinic	Air Force	FY90	$5,408,805	62,661	0
Clinic	Air Force	FY92	$5,548,538	55,325	0
Clinic	Air Force	FY90	$4,141,730	42,449	0
Clinic	Air Force	FY92	$4,403,002	44,053	0
Clinic	Air Force	FY90	$4,936,101	57,413	0
Clinic	Air Force	FY92	$5,864,185	58,330	0
Clinic	Air Force	FY90	$2,453,639	32,500	0
Clinic	Air Force	FY92	$3,175,482	32,340	0
Clinic	Air Force	FY90	$6,425,173	69,397	0
Clinic	Air Force	FY92	$6,486,254	84,015	0
Clinic	Air Force	FY90	$2,968,466	31,494	0
Clinic	Air Force	FY92	$3,449,272	32,251	0
Clinic	Air Force	FY90	$4,690,709	53,875	0
Clinic	Air Force	FY92	$5,200,937	53,358	0
Clinic	Air Force	FY90	$6,436,432	79,113	0
Clinic	Air Force	FY92	$6,271,038	72,266	0
Clinic	Air Force	FY90	$7,848,717	109,069	0
Clinic	Air Force	FY92	$8,908,053	134,852	0
Clinic	Air Force	FY90	$4,203,921	50,093	0
Clinic	Air Force	FY92	$5,017,675	56,478	0
Clinic	Air Force	FY90	$3,137,744	37,862	0
Clinic	Air Force	FY92	$4,297,298	39,473	0
Clinic	Air Force	FY90	$1,927,035	26,548	0
Clinic	Air Force	FY92	$2,271,748	21,538	0
Clinic	Air Force	FY90	$4,795,991	64,049	0
Clinic	Air Force	FY92	$2,220,807	28,415	0
Clinic	Air Force	FY90	$4,108,891	50,832	0
Clinic	Air Force	FY92	$4,019,439	39,783	0
Clinic	Air Force	FY90	$4,989,265	60,651	0

Table E-1. Data Used for Ambulatory Regression Model (Continued)

Facility Type	Service Branch	Fiscal Year	Observed Ambulatory Expenses	Total Visits	Residents plus Interns
Clinic	Air Force	FY92	$5,730,321	50,941	0
Clinic	Air Force	FY90	$4,958,692	55,445	0
Clinic	Air Force	FY92	$4,184,182	52,576	0
Clinic	Air Force	FY90	$9,154,964	149,706	0
Clinic	Air Force	FY92	$10,480,267	155,263	0
Clinic	Air Force	FY90	$3,608,189	29,659	0
Clinic	Air Force	FY92	$929,016	30,944	0
Clinic	Air Force	FY90	$3,094,781	20,651	0
Clinic	Air Force	FY92	$3,011,962	22,825	0
Clinic	Air Force	FY90	$5,109,233	61,421	0
Clinic	Air Force	FY92	$4,716,101	42,578	0
Clinic	Air Force	FY90	$1,920,924	21,475	0
Clinic	Air Force	FY92	$2,827,627	21,227	0
Clinic	Air Force	FY90	$5,180,999	47,014	0
Clinic	Air Force	FY92	$4,951,926	43,494	0
Clinic	Air Force	FY90	$1,744,580	18,820	0
Clinic	Air Force	FY90	$2,236,954	11,266	0
Clinic	Air Force	FY92	$2,645,802	11,482	0
Clinic	Air Force	FY90	$2,542,112	14,891	0
Clinic	Air Force	FY92	$3,007,387	13,907	0
Clinic	Air Force	FY90	$2,418,141	19,986	0
Clinic	Air Force	FY92	$2,373,893	23,526	0

APPENDIX F
ABBREVIATIONS

ABBREVIATIONS

ACH	Army Community Hospital
AFB	Air Force Base
AFR	Air Force Reserve
AFSC	Air Force Specialty Code
AFSP	Armed Forces Scholarship Program
AH	army hospital
AMC	Air Mobility Command *or* Army Medical Center
AMS	Army Management Structure
ANG	Air National Guard
ASW	anti-submarine warfare
ATH	air transportable hospital
AWACS	airborne warning and control system
BAQ	basic allowance for quarters
CENTCOM	Central Command
CHAMPUS	Civilian Health and Medical Program of the Uniformed Services
CMA	case-mix adjusted
CmbtZ	combat zone
CMI	case-mix index
COMA	Cost of Medical Activities
CommZ	communications zone
CONUS	continental United States
CRI	CHAMPUS Reform Initiative
CSH	Combat Support Hospital
DBOF	Defense Business Operations Fund
DMDC	Defense Manpower Data Center
DMFO	Defense Medical Facilities Office
DMIS	Defense Medical Information System

DMSSC	Defense Medical Systems Support Center
DNBI	disease/non-battle injury
DoD	Department of Defense
DRG	Diagnosis Related Group
EA	economic analysis
FBMS	Fleet Ballistic Missile System
FEHBP	Federal Employees Health Benefits Plan
FFS	fee-for-service
FICA	Federal Insurance Contributions Act
FISA	Force Integration Support Agency
FORSCOM	Forces Command
FSSG	force service support group
FTE	full-time equivalent
FY	fiscal year
FYDP	Future Years Defense Program
GAO	General Accounting Office
GME	Graduate Medical Education
HCFA	Health Care Financing Administration
HMO	health maintenance organization
IDA	Institute for Defense Analyses
IF	industrial fund
IMA	Individual Mobilization Augmentee
JOPES	Joint Operational and Planning Execution System
JUMPS	Joint Uniformed Military Payroll System
LAMPS	light airborne multi-purpose system
LANTCOM	Atlantic Command
MASH	Mobile Army Support Hospital
MAW	Marine air wing
MEPRS	Medical Expense and Performance Reporting System
MFP	Major Force Program
MilPers	military personnel
MOS	Military Occupational Specialty

MPM	Medical Planning Model
MSC	Medical Service Corps
MTF	military treatment facility
NEC	Navy Enlisted Classification
NH	Naval Hospital
NNMC	National Naval Medical Center
NOBC	Navy Officer Billet Classification
O&M	Operations and Maintenance
OASD	Office of the Asistant Secretary of Defense
OASD(P&R)	Office of the Assistant Secretary of Defense (Personnel and Readiness)
OCONUS	outside the continental United States
OD(PA&E)	Office of the Director (Program Analysis and Evaluation)
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense
P&D	planning and design
P&R	Personnel and Readiness
PA&E	Program Analysis and Evaluation
PACOM	Pacific Command
PCS	permanent change-of-station
PE	Program Element
PPO	preferred-provider organization
ROTHR	relocatable over-the-horizon radar
RPMA	real property maintenance activity
SOFCOM	Special Operations and Forces Command
SOUTHCOM	Southern Command
TAADS	The Army Authorization Document System
TAD	temporary additional duty
TDY	temporary duty
TPU	Troop Program Unit
UMC	unspecified minor construction
USAF	United States Air Force

USEUCOM	United States European Command
USSTRATCOM	United States Strategic Command
USUHS	Uniformed Services University of the Health Sciences
VRI	Vector Research, Incorporated

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	September 1994	Final Report, Jun 1992 – Sep 1994

4. TITLE AND SUBTITLE
Cost Analysis of the Military Medical Care System: Final Report

5. FUNDING NUMBERS
MDA 903 89C 0003
T-Q7-1085

6. AUTHOR(S)
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Institute for Defense Analyses
1801 N. Beauregard Street
Alexandria, VA 22311-1772

8. PERFORMING ORGANIZATION REPORT NUMBER
IDA Paper P-2990

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Office of the Director (Program Analysis and Evaluation)
Room 2D311, The Pentagon
Washington, DC 20301

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12A. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

12B. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

In FY 1992, the Congress mandated that DoD conduct a comprehensive study of the military medical-care system. As part of that effort, IDA was tasked to analyze the cost structure of military hospitals. IDA first established a baseline medical expenditure of $15.6 billion for FY 1990. That estimate is about 10% higher than previous official estimates. IDA also developed models that relate cost to workload for individual military hospitals. IDA's models were based on data from the Medical Expense and Performance Reporting System (MEPRS), which is known to understate some of the cost elements. As part of the modeling process, IDA developed adjustment factors that render MEPRS data comparable to prices charged in the civilian sector. These adjustment factors range between 11% and 17%. Finally, IDA used its models to project in-house medical costs under four analytical cases. The various cases involve expansion or contraction in system-wide capacity, corresponding changes in workload and, in a few instances, competition for enrollment of beneficiaries. The Office of the Director (Program Analysis and Evaluation) combined IDA's cost projections for the cases with its own analysis, and published the overall study findings under separate cover.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Health Care Facilities, Medical Services, Costs, Cost Estimates, Department of Defense	248
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	SAR

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18
298-102

UNCLASSIFIED